Original Research Article

Nutrient Digestibility and Growth Performance of Finisher Broilers Given Dried *Xylopia aethiopica* Fruits (Grains of Selim) As Additive

ABSTRACT

The nutrient digestibility and growth performance of finisher broilers given dried *Xylopia aethiopica* fruits (grains of selim) as additive was investigated. One hundred and ninety five finisher broilers (Arbor acres strain), 28- day old were randomly shared into five treatments with each treatment having three replicates. Blended grains of selim was administered orally through drinking water on treatments 2, 3, 4 and 5 at concentrations of 0.4, 0.6, 0.8 and 1.0g per litre respectively while birds on treatment 1 (control) received 0.3g/litre of antibiotics (doxygen). Birds were fed *ad libitum* with the same isoproteinous and isocaloric diet containing 20% crude protein and 2905.95 Kcal/kg metabolisable energy for 28 days. Results showed no significant (P>0.05) differences among treatments in the final body weight, total weight gain, daily weight gain, total feed intake, daily feed intake and feed conversion ratio. Nutrient digestibility were similar (P>0.05) in all treatment groups . Results of this study demonstrated that grains of selim could be used as a substitute for antibiotic growth promoters. The growth performance obtained was a true reflection of the nutrient digestibility and utilization efficiency of finisher broilers given the additives.

Keywords*: antibiotics, finisher broilers, growth promoter, nutrient, digestibility, Xylopia aethiopica dried fruits (grains of selim).*

1. INTRODUCTION

The Xylopia aethiopica tree is a slim, tall, evergreen, aromatic plant growing up to a height of 20m, of the order Magnoliales and family Annonaceae and found in the tropical zones of west , central and southern Africa [1]. The dried fruits of *Xylopia aethiopica* (Grains of Selim) have long been used as a spice and an herbal medicine. The use of antibiotics as growth promoters in poultry production and reports on their residual effects on consumers of poultry products have generated interest in producers trying to do without antibiotics and other drugs [2]. The need to adopt a more nutrition-based health strategy in animal production and development have been advocated [2]. This is important because consumers are now paying much more attention to quality and safety of poultry products they eat [3]. It has been observed and reported that grains of selim has antimicrobial and anthelminthic activities and promotes growth in broiler chickens [4]. Several herbal products and their extracts have being found to improve broiler performance and exhibited growth-promoting effects [5]. Therefore, it has been opined that herbal products could serve as an environmental friendly alternatives to the antibiotic growth promoters [4]. The high cost of antibiotics and other drugs in addition to the residual effects of their use has necessitated the need to research into natural herbal plants that could serve as good, cheap and natural alternatives to commercial (synthetic) antibiotics. This study was designed to investigate the effect of grains of selim (*Xylopia aethiopica* dried fruits) as additive on the nutrient digestibility, retention and growth performance of finisher broilers.

2. MATERIALS AND METHODS

2.1 Experimental Site: The Poultry Research Unit of the Department of Animal Science, Delta State University, Asaba Campus, Nigeria, was the experimental site. All experimental procedures used in this study were approved by the Boards of Studies of the Department of Science and Faculty of Agriculture, Delta State University, Abraka, Asaba Campus, Nigeria.

2.2 Experimental Birds and Management: One hundred and ninety five (195) 28 days old finisher broilers (Arbor acres strain) weighing from 1377-1454.67 ±16.85 g were used in this study. A deep litter house of fifteen pens with dimensions of 2.04m x 2.03m was used in the experiment to manage the birds. Feed and water were supplied *ad libitum* throughout the period and required vaccinations were given.

2.3 Experimental Design: The finisher broilers were randomly assigned into five treatment groups with three replicates on equal weight basis in a completely randomized design. Each treatment group had 39 birds and 13 per replicate.

2.4 Experimental Diets: Birds were fed the same isoproteinous and isocaloric diet containing 20% crude protein and 2905.95Kcal/kg metabolizable energy. Well blended powdered grains of selim was obtained by pulverizing with mortar and pestle, milling with homogenizer and passed through a standard 2mm sieve to remove all fibrous materials. Weights of 0.4, 0.6, 0.8g and 1.0g of grains of selim were dissolved in a litre of water each for more than 10 hours and given to broilers in treatments 2, 3, 4 and 5 as their drinking water, while broilers in treatment 1 (Control) were given antibiotics in their water (0.3g per litre of water). The proximate and phytochemical compositions of *Xylopia aethiopica* dried fruits(grains of selim) are presented in Table 1. The composition of the finisher broiler diet is presented in Table 2.

2.5 Measurements: The mean body weight , body weight gain, feed intake and mortality data were collected in each replicate weekly. Feed conversion which is a ratio of feed consumed and the weight gained over a specific period was also calculated .

2.6 Metabolic Trials :At the end of 28 days when the birds were 8 weeks old, one bird per replicate weighing close to the general average body weight (3290.20 ± 45.12g) were selected from the five treatment groups for metabolic study. Birds were kept individually in battery cages and provided with feed and water *ad libitum.* After an adjustment period of three days, dropping trays covered with aluminium foil paper were placed under the cages for total excreta collection for three days. The faecal droppings from each replicate were oven dried at low temperature range of 60-80°C to minimise loss of nitrogen to a constant weight. The total collection from each replicate were then bulked, weighed and milled to pass through a standard 2mm sieve, and representative samples of the droppings and experimental diet were analysed for their proximate compositions for the determination of nutrient digestibility and retention.

2.7 Chemical Analysis: The proximate compositions of grains of selim, experimental diet and faecal samples were determined according to AOAC [6] procedure and the phytochemical analysis was carried out by the methods of Sofowora [7] and Trease and Evans [8].

2.8 Statistical Analysis: All data collected were subjected to one way analysis of variance (ANOVA) for completely randomized design using SPSS [9] statistical package. Significant differences among the treatment means were separated using Duncan multiple range test [10].

Table 1. Proximate and Phytochemical Compositions of *Xylopia aethiopica* Dried fruits

Parameters %		Phytochemical Test	Results
Dry matter	87.95	Flavonoid	+++
Ash(%)	5.84	Tannin	++++
Crude fibre	10.51	Alkaloid	++
Crude protein	2.73	Steroid	++
Ether extract	9.9	Saponin	+
Nitrogen free extract	58.97	Carbohydrate	+

+ = slightly present, ++= moderately present, +++= present, ++++= strongly present

3. RESULTS

The resuls of the phytochemical analysis showed that grains of selim contain the following phytochemicals: alkaloids, tannins, flavonoids, steroids, saponin and carbohydrates.

The results of the performance characteristics of the finisher broilers given different concentrations of grains of selim in drinking water are presented in Table 3. There were no significant (P>0.05) differences in final body weight, total weight gain, daily weight gain, total feed intake, daily feed intake and feed conversion ratio across the treatment groups. However, finisher broilers in treatments given grains of selim had slightly higher values in final body weight, total weight gain, daily weight gain and feed conversion ratio than broilers in treatment 1 given antibiotic. The results of nutrient digestibility of finisher broilers given different concentrations of grains of selim are presented in Table 4. There were no significant (P>0.05) differences in ash, crude fibre, crude protein, ether extract and nitrogen free extract digestibilities in all treatment groups.

Table 2. Composition of Experimental Finisher Broilers Diet

Ingredients	Treatments T1* 0.3g/litre (antibiotic)	T2** 0.4g/litre	T3** 0.6g/litre	T4** 0.8g/litre	T5** 1.0g/litre
Maize	**58.00**	**58.00**	**58.00**	**58.00**	**58.00**
Soyabean cake	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**
Groundnut cake	**9.00**	**9.00**	**9.00**	**9.00**	**9.00**
Fish meal	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**
Weath offal	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**
Palm oil	**1.20**	**1.20**	**1.20**	**1.20**	**1.20**
Bone meal	**3.20**	**3.20**	**3.20**	**3.20**	**3.20**
Limestone	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**
Salt	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
Premix	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
Methionine	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**
Lysine	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis:					
Crude protein (%)	**20.07**	**20.07**	**20.07**	**20.07**	**20.07**
Crude fibre (%)	**3.57**	**3.57**	**3.57**	**3.57**	**3.57**
M E Kcal/kg	**2905.95**	**2905.95**	**2905.95**	**2905.95**	**2905.95**
Determined analysis:					
Dry matter (%)	**87.84**	**87.84**	**87.84**	**87.84**	**87.84**
Ash (%)	**9.22**	**9.22**	**9.22**	**9.22**	**9.22**
Crude fibre (%)	**11.33**	**11.33**	**11.33**	**11.33**	**11.33**
Crude protein (%)	**20.86**	**20.86**	**20.86**	**20.86**	**20.86**
Ether extract (%)	**3.09**	**3.09**	**3.09**	**3.09**	**3.09**
Nitrogen free extract (%)	**43.34**	**43.34**	**43.34**	**43.34**	**43.34**

Each 2.5kg of finisher vitamine-mineral premix (Bio Organic nutrient systems LTD Nigeria) provided the following vitamins and minerals. Vit A, 8,500,000.00 I.U; Vit D3,1,500,000.00 I.U; Vit E, 10,000.00 I.U; Vit K3,1,500.00mg; Vit B1,1,600.00mg; Vit B2,4000.00mg; Niacin, 20,000.00mg; Pantothenic acid; 5000.00mg; Vit. B6, 1,500.00mg; Vit B12, 10.00mg; Folic acid,500.00mg; Biotin 750.00mg, Choline chloride175,000.00mg, Cobalt 200.00mg; Copper 3,000.00mg;Iiodine 1,000.00mg; Iron, 20mg,Manganise,40,000.00; Selenium200.00; Zinc30.000.00; Antioxidant, 1,250.00 *Antibiotics (Doxy-gen 20/20 WSP : Doxycycline d hyclate 200mg and Gentamicine de sulfate 200mg) **Grain of selim. ME: Metabolizable energy.

Table 3.: Performance Characteristics of Finisher Broilers Given Different Concentrations of *Xylopia aethiopica* Dried Fruits (grains of selim) in Drinking Water.

	Treatments						
Parameters	T1* 0.3g/litre	T2** 0.4g/litre	T3** 0.6g/litre	T4** 0.8g/litr	T5** 1.0g/litre	SEM	SIG
Initial weight (g)	1431.00	1454.67	1421.00	1377.00	1431.33	16.85	NS
Final body weight (g)	3186.00	3274.33	3181.33	3415.33	3394.00	45.12	NS
Total weight gain (g)	1754.00	1867.67	1789.33	2009.33	1891.33	47.72	NS
Daily weight gain (g)	62.64	66.70	63.90	71.76	67.55	170.46	NS
Total feed intake (g)	4786.00	4888.67	4751.67	4727.67	4543.00	76.20	NS
Daily feed intake (g)	170.93	174.60	169.70	168.84	162.25	27.22	NS
Feed conversion ratio	2.74	2.65	2.67	2.34	2.42	0.071	NS

*Antibiotics (Doxy-gen 20/20 WSP : Doxycycline d'hyclate 200mg and Gentamicine de sulfate 200mg) **Grains of selim
NS: Not significant

Table 4 Nutrient Digestibility of Broilers Given Different Concentrations of *Xylopia aethiopica* Dried Fruits (grains of selim) in Drinking Water

	Treatments						
Parameters	T1* 0.3g/litre	T2** 0.4g/litre	T3** 0.6g/litre	T4** 0.8g/litre	T5** 1.0g/litre	SEM	SIG
Ash %	88.53	80.7	90.28	90.17	92.49	1.87	NS
Crude fibre %	91.83	82.86	88.31	88.27	90.50	1.88	NS
Crude protein %	92.11	83.7	91.69	94.41	94.51	1.61	NS
Ether extract %	82.79	72.98	69.83	76.22	87.53	4.23	NS
Nitrogen free extract %	78.45	78.95	72.07	77.06	81.53	5.05	NS
Digestibility of feed %	82.30	81.72	82.98	84.37	85.57	0.71	NS

*Antibiotics (Doxy-gen 20/20 WSP: Doxycycline d'hyclate 200mg and Gentamicine de sulfate 200mg)
**Grains of selim. NS: Not significant

4. DISCUSSION

The results of the phytochemical analysis showed that grains of selim has alkaloid, flavonoid, tannin, steroid and carbohydrate present in it while saponin is marginally present. These phytochemicals have been documented to possess analgesic, antispasmodic and bactericidal activities, have been found to be antimicrobial substances against a wide array of microorganisms *in vitro*, effective antioxidant and anti carcinogenic properties, they also lower the risk of heart diseases and have important relationship with sex hormones [7,11, 12]. The identified phytochemical compounds obtained in this study may be the bioactive constituents of this spice. Grains of selim is

therefore, proving to be a valuable reservoir of bioactive compounds of substantial medicinal merit [11]. In line with the present observation, phytochemical screening of *Xylopia aethiopica* oil revealed the presence of plant sterols and phenolic compounds such as flavonoids, tannins and the saponins [13, 14, 15, 16].

The similarities in the final body weights, total weight gain, daily weight gain, total feed intake, daily feed intake and feed conversion ratio in Table 3. is an indication that finisher broilers in all treatment groups responded positively in growth performance to the diet and additives supplied. The growth performance pattern in treatment 1 given antibiotic (Doxy-gen 20/20 WSP : Doxycycline d'hyclate 200mg and Gentamicine de sulfate200mg) compared to the other treatments given grains of selim indicate that grains of selim has growth promoting potentials just like antibiotics, therefore grains of selim can be used to replace antibiotics as additive in finisher broiler production. These results are similar to the improved growth performance obtained [4] when different concentrations of grains of selim in drinking water was given to broiler chicks, and similar to reports on antibiotics growth promoters. Similarly improved body weight gain, daily feed intake and feed conversion ratio was observed in broilers fed powder or aqueous extract of garlic compared to those fed control diet [17, 18, 19, 20]. The result of this study agree with the findings on dietary ginger [21, 22, 23, 24, 25] and thyme [26, 27, 28, 29, 30] which also gave improved body weight gain in broilers. These authors on dietary ginger [21, 22, 23, 24, 25] and thyme [26, 27, 28, 29, 30] concluded that thyme and ginger (oil, powder or aqueous extract) could be promising natural alternatives to antibiotics growth promoters. The similarities in feed intake and feed conversion ratio which conform to the growth pattern of the birds in this study also agree with the reports of these authors. The improved performance of birds as a result of grains of selim may be attributed to the presence of the several bioactive compounds in the fruits (Carbohydrates, flavoniods, sterols, saponins, tannins, and alkaloids) which have biological activities such as antioxidant, antimicrobial and pharmacological effects [4]. However the final weight of broiler finishers given different concentrations of grains of selim compared to the control revealed that grains of selim can replace antibiotics in broiler finishers with positive effect on body weight performance.

The similarities in digestibility of all nutrients across the treatment groups is an indication that nutrient utilization efficiency of broiler finishers given different concentrations of grains of selim were not adversely affected. The results of nutrient digestibility followed the pattern of the growth performance of the treatment groups, indicating that nutrient utilization proceeded at the same rate and efficiency whether broilers were given grains of selim or antibiotics as additive. The notably high values of nutrient digestibility of broiler finishers given grains of selim and antibiotics as additives, showed that their antimicrobial and antioxidant properties helped to provide a favourable and conducive internal environment within the birds systems for efficient utilization of available nutrients for high productivity, which in this case is the growth performance. The daily weight performance of the broilers was, therefore, a true reflection of the efficiency of nutrient digestibility and utilization.

5. CONCLUSION

The growth performance and the efficient utilization of nutrients as revealed by the high values of nutrient digestibility and growth, indicate that *Xylopia aethiopica* dried fruits (grains of selim) can give improve nutrient digestibility and growth in broiler finishers. The antimicrobial and antioxidant properties of grains of selim already reported may have provided a conducive internal environment within the birds for high and improved performance. *Xylopia aethiopica* can serve as a natural alternative to antibiotics as a growth promoter in broiler finisher production.

REFERENCES

1. Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A. (2009). Agroforestree

Database:a tree reference and selection guide version 4.0 World Agroforestry Centre, Kenya.

2. Hossain, M.M. Herbs versus drugs: Aspect World Poultry. 2009. Accessed February 14, 2015. Engormix.com/./165/po.htm

3. Yegani M, Smith TK, Leeson S, Boermans HJ. Effects of feeding grains naturally contaminated with Fusarium mycotoxins on performance and metabolism of broiler breeders. Poult. Sci. 2006; 85: 1541-1549.

4. Isikwenu JO. (2014) Xylopia aethiopica dried fruits (Grains of selim) as additive in starter broiler production. Proc. 14th Euro. Poult. Conf. 2014; 578. Stavanger, Norway.

5. Karimi A, Yan F, Coto C, Park JH, Min Y, Lu C, Gidden JA. Lay JO, Waldroup PW. Effect of level and source of oregano leaf in starter diet for broiler chickens. J. Appl. Poult. Res. 2010; 19 (2): 137-145.

6. AOAC. Official methods of analysis, 15th edition. Association of Official Analytical Chemists, Washington D. C.; 1990.

7. Sofowora A. Medicinal plants and medicine in africa. John Whilley Spectrum Books, Ibadan, Nigeria. 1993; 120-123.

8. Trease GE, Evans WC. Textbook of pharmacognosy. 1989. 12th ed. Ballere, Tinall London.

9. SPSS (Statistical Package for the Social Sciences). 17.0 . SPSS Inc. Chicago, IL, 60606.

10. Duncan DB. Multiple range and multiple F-tests. Biometrics. 1955; 11:1 – 42

11. Yadav RNS, Munin A. Phytochemical analysis of some medicinal plants. J. Phyto. 2011; 3 (12): 10-14.

12. Okigbo RN, Anuagasi CL, Amadi JE, Ukpabi UJ. Potential inhibitory effects of some african tuberous plant extracts on Escherichia coli, Staphylococcus aureus and Candida albicans. Int. J. Integr. Biol. 2009; 6 (2): 91-98.

13. Edeoga HO, Okwu DE, Mbaebie BO. Phytochemical constituents of some Nigerian medicinal plants. Afri. J. Biotech. 2005; 4 (7): 685-688.

14. Kumar RS, Sivakuma T, Sunderem RS, Gupta M, Murugesh K, Rajeshwa Y, Kumar MS, Kumar KA. Antioxidant and antimicrobial activities of Bauhinia recemosa L. stem bark. Braz.J. Med. Biol. Res. 2005;38: 1015-

15. Law M. Plant sterol and stanol margarines and health. Br. Med J. 2000; 320: 72-

16. Ostlund RE Jr. Phytosterols in human nutrition, Ann. Rev. Nutr. 2002; 22: 533-549.

17. Aji SB, Ignatius K, Ado AY, Nuhu JB, Abdulkarim A. Effects of feeding onion (Allium cepa) and garlic (Allium sativum) on some performance characteristics of broiler chickens. Res. J. Poult. Sci. 2011; 4:22-27.

18. Mansoub NH. Comparison of effects of using thyme and probiotic on performance and serum composition of broiler chickens. Advc. Environtl. Biol. 2011; 5: 2012 – 2015.

19. Pourali M, Mirghelenj SA, Kermanshahi D. (2010). Effect of garlic powder on productive performance and immune response of broiler chickens challenged with newcastle disease virus. Globa Veterinaria. 2010; 4: 616 – 621.
20. Kumar S, Sharadmma KC, Radhakrishna. Effect of garlic active based growth promoter on growth performance and specific pathogenic intestinal microbial counts of broiler chicks. Int. J. Poult. Sci. 2010; 9: 244-246.

21. Tekeli A, Kutlu HR, Celik L. Effect of Z. officinale and propalis extracts on the performance, carcass and some blood parameters of broiler chicks. Current Res. Poult. Sci. 2011; 1:12 – 23.
22. Herawati . The effect of feeding red ginger as phytobiotic on body weight gain, feed conversion and internal organs condition of broiler. Int. J. Poult. Sci. 2010; 9(10): 963 – 967.
23. Onu PN. Evaluation of two herb spices as feed additives for finisher broilers. Biotech. Ani. Husbdry. 2010; 26: 383 – 392.
24. Javed M, Durrani F, Hafeez A, Khan RU, Ahmad I. Effect of aqueous extract of plant mixture on carcass quality of broiler chicks. ARPN J. Agri. Biol. Sci. 2009; 4:37 – 40.
25. Farinu GO, Ademola SG, Ajayi AO, Babatunde GM. Growth, haematological and biochemical studies on garlic and ginger-fed broiler chickens. Moor J. Agri. Res. 2004; 5:122-128.
26. Al-Mashhadani EA, Farah KA, Farhan YM, Al-Mashhadani HE. Effects of anise, thyme essential oils and their mixture on broiler performance and some on physiological traits. Egypt. Poult. Sci. 2011; 31: 481-489.
27. Toghyani M, Tohidi M, Gheisari AI, Tabeidian SA. Performance, immunity, serum biochemical and haematological parameters in broiler chick fed dietary thyme as alternative for an antibiotic growth promoter. Afri. J. Biotech. 2010; 9:6819 – 6825.
28. Al-Kassie GAM. Influence of two plants extracts derived from thyme and cinnamon on broiler performance. Pakistan Vet. J. 2009; 29: 169-173.
29. Bolukbasi SC, Erhan MK, Ozkan A. Effects of dietary thyme oil and vitamin E on growth, lipid oxidation, meat fatty acid composition and serum lipoproteins of broilers. South Afri. J. Ani. Sci. 2006; 36: 189 – 196.
30. Zhang K, Yan YF, Keen CA, Waldroup PW. Evaluation of microencapsulated essential oils and organic acids in diets for broiler chickens. Int. J. Poult. Sci. 2005; 4:612 – 619.