



Growth Performance and Carcass Characteristics of Broiler Chickens Fed Diets Containing Graded Levels of Black Olive (*Canarium schweinfurthii*) Seed Meal

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Abstract

*The study was conducted to evaluate the effect of Black olive (*Canarium schweinfurthii*) seed meal on the growth performance and carcass characteristics of broiler chickens. A total of 375-day-old Ross broiler chicks were allotted to five dietary treatments containing *Canarium schweinfurthii* seed meal at 0 g (T1), 250 g (T2), 500 g (T3), 750 g (T4) per Kg diet and oxytetracycline was used as positive control (T5) in a completely randomized design. All data generated were subjected to Analysis of Variance and significant difference among treatment means were compared using Duncan's Multiple Range Tests procedures. Growth performance results showed that final weight, weight gain, feed cost/Kg gain and feed conversion ratio were significantly ($P<0.05$) higher in birds fed diet supplemented with oxytetracycline (AGP) at both starter and finisher phases. Carcass characteristics of cut parts showed that birds on AGP had higher ($P<0.05$) drumstick and breast cut percentage compared to other dietary treatments. Organ weights such as liver, kidney and heart were significantly ($P<0.05$) higher in birds fed diets supplemented with *Canarium schweinfurthii* seed meal. Therefore, inclusion of *Canarium schweinfurthii* seed meal at 500 g/100kg diet improved broiler chickens' performance.*

Keywords: Broiler, Carcass, *Canarium schweinfurthii* and Growth

Introduction

The use of antibiotics in poultry feed at sub-therapeutic level as an antimicrobial growth promoter (AGPs) has been beneficial to growth performance and carcass yield (Hume, 2011). Besides the positive effect, there are also negative effects such as production of resistant strains of enterobacteria. The European Union banned feed grade antibiotic growth promoters, due to not only cross resistance, but also the risk of possible drug multiple resistance in human pathogenic bacteria (Shane *et al.*, 2001). Natural growth promoters such as prebiotics, probiotics, organic acids, enzymes and plant extract are incorporated into broiler chickens' diet without any detrimental effect on their growth and performance (Dhama *et al.*, 2011). Beneficial properties of bioactive plant constituents in animal nutrition may comprise of the stimulation of appetite and feed intake, the enhancement of endogenous digestive enzyme secretion, stimulation of

immune responses and antibacterial, antiviral and antioxidant action (Al-Amin *et al.*, 2006).

Plant derived additives (PFA) to improve animal performance are called "phytogenic feed additives" (Windisch *et al.*, 2008). Many researches in animal production have breakthrough with the use of nutritional supplement and incorporation of this phytogenic feed additives into livestock feed. Powdery or essential oils of ginger (*Zingiber officinale*), thyme (*Thymus vulgaris*), garlic (*Allium sativum*), turmeric (*Curcumin longa*) and chilli (*Capsicum annum*) are used singly or in combination as feed additives (Puvaca *et al.*, 2013). The addition of PFA to feed and drinking water supports digestion and metabolism in the body, stimulates the growth and development of useful microbiome, limits the multiplication and adhesion of pathogens and improves the structure and functioning of enterocytes.

Black Olive (*Canarium schweinfurthii*) has been used for a long time in African traditional medicine to treat numerous ailments of the human body. Black Olive (*Canarium schweinfurthii*) belongs to the family *Burseraceae* and the genus *Canarium* (Keay, 1989; Nyam, 2011). *Canarium schweinfurthii* fruit are common in Bauchi, Southern Kaduna, Niger and Plateau States of Nigeria (Nyam, 2011). *Canarium schweinfurthii* seed contains natural flavour, high fat content, pigments, nutritionally valuable minerals, vitamins and naturally occurring antioxidants (Ayoade *et al.*, 2015). The seeds are sources of crude fibre (Aremu *et al.*, 2006 and Maduelosi and Angaye, 2015), ash (Igidi and Edene, 2014, Qin *et al.*, 2009), vitamin C and flavour in snacks and non- alcoholic beverages (Ayoade, *et al.*, 2015, Maduelosi and Angaye., 2015) as well as protein and carbohydrate (Ayoade *et al.*, 2017). The seed also contains appreciable amount of nutritionally valuable minerals such as calcium, potassium, magnesium, sodium, phosphorous, iron, zinc and copper (Ayoade *et al.*, 2017) and organic acids (Okpala, 2016). *Canarium schweinfurthii* contain some active chemical compounds in all its parts; leaves: Saponins, tannins, cardiac glycoside, steroids and flavonoid (Ngbede *et al.*, 2008); and seeds: Tannin, balsams, phenols and flavonoids (Uzama *et al.*, 2012).

Canarium schwenfurthii as a phytogenic feed additive was reported to have enhanced performance, feed conversion ratio, carcass yield and reduce pathogenic bacteria that interferes with effective utilization of feed in poultry (Dhama *et al.*, 2015). Hence, this is study was designed to evaluation of *Canarium schwenfurthii* as phytogenic feed additive on the growth performance and carcass characteristics of broiler chickens.

Materials and Methods

Location of the study

The experiment was conducted at the Poultry Unit, Teaching and Research Farm, Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State. Zaria is located in the Northern Guinea Savannah zone of Nigeria, located on longitude, 11⁰ 09' 01.78'' N and latitude, 7⁰ 39'14 79'E at an altitude of 671 mm above sea level. The climate is characterized by a well-defined dry and wet season. The climate is tropical with annual temperature of 24.9⁰C and rainfall averages 1050 mm (IARMS, 2019).

Source of Black Olive (*Canarium schweinfurthii* Linn)

The fruits of *Canarium schweinfurthii* were sourced from Pankshin Local Government Area of Plateau state. The pulps were separated from the seeds, while the fruit meal which constitute of pulp and whole seed was sun-dried and milled separately. Samples of the pulp, whole seed and fruit meal were taken to Animal Science Biochemical Laboratory, Ahmadu Bello University, Zaria for proximate analysis using the method described by A.O.A.C. (2005).

Experimental diet

Five (5) experimental diets were formulated with *Canarium schweinfurthii* seed meal; which were denoted as; Diet 1: (Control diet) without *Canarium schweinfurthii* seed meal, Diet 2: 250 g of *Canarium schweinfurthii* seed meal/100 Kg diet, Diet 3: 500 g of *Canarium schweinfurthii* seed meal/100 Kg diet, Diet 4: 750 g of *Canarium schweinfurthii* seed meal/100 Kg diet and Diet 5: Standard diet with Oxytetracycline as feed additive (111 g/100kg diet dosage as recommended by manufacturer). The starter and finisher diets were iso-nitrogenous and iso-caloric containing 23.21% crude protein

and 2905.00 Kcal/kg and 20.00% crude protein and 2934.00 Kcal/kg, respectively.

Experimental design and management of birds

Three hundred and seventy-five (375) day-old Ross broiler chicks of both sexes were purchased from a reputable hatchery and used for the experiment. After taking the initial weights, chicks were allotted to five (5) dietary treatments in a completely randomized design (CRD). Each treatment was replicated 3 times with 25 birds per replicate making a total of 75 birds per treatment. The birds were raised in deep litter pens and managed with all necessary routine management practices. Birds were supplied with experimental diets and clean water *ad-libitum* throughout the period of the study. The experiment lasted for 4 weeks each at the starter and finisher phases. Intra-treatment randomization was carried out after the starter phase to adjust treatment groups for similar weights for the finisher phase.

Growth study and carcass analysis

Initial and final weights of bird were taken at the beginning and at the end of both starter and finisher phases. Body weight gain and feed intake were measured weekly. Feed/gain ratio and cost/ kg gain were computed for both phases. Mortality was recorded as it occurred. At the end of the experiment, one bird from each replicate (three birds per treatment) were selected based on average group weight and used for carcass analysis. The birds were starved of feed overnight so as to allow for the emptying of the crop and excretion of undigested feed. Each bird was weighed, slaughtered and eviscerated and cut into parts to obtain the dressed weight, breast weight, thigh weight, liver, heart and gizzard. The cut parts were expressed as percentages of dressed weight of birds slaughtered while the organ weights were expressed as percentages of the live weight. The carcass

evaluation was done at the Animal Product Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria.

Data analysis

All data obtained from the study were subjected to analysis of variance using the General Linear Model procedure of Statistical Analysis System (SAS, 2005) and significant differences among means were compared using Duncan's Multiple Range Tests (Duncan, 1955).

Results and Discussion

Growth performance of broiler chicks fed diets containing *Canarium schweinfurthii* seed meal (0-4 weeks)

The growth performance of broiler chicks fed diets containing *Canarium schweinfurthii* seed meal as phytogetic feed additive is presented in Table 1. The results showed that there were significant ($P<0.05$) differences in final weight, weight gain, feed cost/kg gain, feed conversion ratio (FCR). It was observed that final weight and weight gain were higher ($P<0.05$) in broiler chicks fed control diet and chicks on diet supplemented with oxytetracycline (AGPs). Feed intake was higher ($P<0.05$) in broiler chicks fed diet containing *Canarium schweinfurthii* pulp meal at 250 g/100kg diet, it was also observed in this study that addition of *Canarium schweinfurthii* seed meal as phytogetic feed additive in broiler chicks diet at the levels of 500 g and 750 g/kg diet reduced feed intake. This may be attributed to the diet's taste. For instance, by the pungency of the phytogetic compound and as a result the feed intake of broiler chicks decreased (Brenes and Roura, 2010). Amd *et al.* (2011) also reported that addition of PFA to the diet of broiler chickens resulted in depression in feed intake. This result contradicts that of Kroismayr *et al.* (2006) who stated that phytogetic feed additive compound has the potential of increasing feed intake through

enhancing palatability of diet due to enhanced flavour and odour.

Feed conversion ratio showed that there was no significant ($P>0.05$) difference in chicks fed control diet, diet supplemented with oxytetracycline (AGPs) and *Canarium schweinfurthii* seed meal at 500 g and 750 g/100kg diet but difference ($P<0.05$) was observed in birds fed diet supplemented with *Canarium schweinfurthii* seed meal at 250 g/100kg diet. This study contradicts the report of Jamroz *et al.* (2003) who reported that feed conversion ratio was improved with increasing phytogetic feed additive in the diet, caused by improved digestion of nutrients. Similarly, feed cost/kg gain and mortality were not significantly ($P>0.05$) affected. It was observed that final body weight was numerically higher in broilers fed control diet and birds fed diet supplemented with oxytet (AGPs) but not significantly ($P<0.05$) different with birds fed diet

supplemented with *Canarium schweinfurthii* seed meal. The higher weight gain observed in chicks fed diet supplemented with *Canarium schweinfurthii* seed meal at 750g/100kg diet may be attributed to improvement of endogenous enzyme secretion, digestibility, microflora balance (increasing the population of beneficial bacteria) in broiler chicks. In a similar study, where the diets of broiler chickens were supplemented with chlortetracycline, oxytetracline and penicillin, it was reported to improve growth rate. Donoghue (2015) reported that feed supplemented with antibiotics stimulated early gut development and improved overall efficiency of broiler chickens gastro intestinal tract. The result of this study contradicts the report of Weerasingha and Atapattu, (2013), who stated that phytogetic feed additives improved growth rate and efficiency of feed utilization.

Table 1: Growth performance of broiler chicks fed diets containing *Canarium schweinfurthii* seed meal (0-4weeks)

Parameters	Levels of <i>Canarium schweinfurthii</i> seed meal (g/100kg)				Oxytet	SEM
	0	250	500	750		
Initial weight (g/b)	40.74	40.12	40.12	39.99	39.66	0.81
Final weight (g/b)	733.12 ^a	717.48 ^a	716.67 ^a	702.78 ^b	748.58 ^a	16.34*
Weight gain (g/b)	692.38 ^a	677.36 ^a	676.55 ^b	662.79 ^b	708.92 ^a	16.14*
Feed intake (g/b)	991.16	1075.72	988.83	927.69	948.43	71.61
FCR	1.43 ^a	1.59 ^b	1.46 ^a	1.39 ^a	1.33 ^a	0.04*
Feed cost/Kg gain (₦/Kg)	259.51 ^b	289.67 ^a	267.30 ^{ab}	256.89 ^{ab}	250.33 ^a	10.96*
Mortality (%)	13.58 ^a	22.22 ^b	11.11 ^a	9.87 ^a	1.23 ^a	5.66*

abc Means with the same superscripts along the rows are not significantly different ($p>0.05$), SEM: standard error of means, Oxytet = Oxytetracycline

Growth performance of broiler chickens fed diet containing *Canarium schweinfurthii* seed meal (5-8 Weeks)

The growth performance of broiler chickens fed diets containing *Canarium schweinfurthii* seed meal as phytoiotics is presented in Table 2. The result showed that there were significant ($P<0.05$) difference in final

weight, weight gain, feed intake, feed conversion ratio and feed cost/kg. Final weight, weight gain and feed intake were significantly ($P<0.05$) higher with broiler chickens fed diet supplemented with oxytetracycline, *Canarium schweinfurthii* seed meal compared to birds on control diet. Feed conversion ratio was better in broiler

chickens fed diets supplemented with oxytetracycline (1.94) and birds fed diet supplemented with *Canarium schweinfurthii* seed meal compared to birds on control diet. This contradicts the report of (Windisch *et al.*, 2008; Brenes and Roura, 2010) who reported that the inclusion of phytogetic compound in poultry feed reduce palatability of diet due to pungent odour, which depress the feed intake without changes in body weight gain leading to an improved feed conversion ratio (FCR). The reason for improvement in nutrient absorption may be partly explained due to stimulation in the secretion of saliva, bile and enhance enzyme activity (Platel and Srinivasan, 2004). Phytogetic feed additives had been reported to improve growth rate and efficiency of feed utilization (Weerasingha and Atapattu, 2013). The higher final weight and total weight gain observed for broiler chickens fed diet supplemented with *Canarium schweinfurthii* seed meal and Oxytetracycline could be as a result of elimination of harmful bacteria load in the gut of the birds leading to higher concentration of beneficial bacterial species

that help in effective feed digestion and nutrient utilization (Khan *et al.*, 2007). The better performance observed in broiler chickens fed diet supplemented with oxytet (AGPs) could be attributed to its antimicrobial effect especially in reducing the pathogenic strains of bacteria, thereby increasing the population of beneficial strains of bacteria. Donogue, (2003) reported that feed supplemented with antibiotics stimulated early gut development and improved overall efficiency of chicken’s gastro-intestinal tract. Feed cost/kg gain were reduced in the treatment groups with experimental material (*Canarium schweinfurthii*) seed meal at 250 g, 500 g and 750 g/100kg diet respectively compared to control diet. This indicates higher return to farmer by the use of *Canarium schweinfurthii* seed meal in broiler chickens diet through reduction in cost of feeding per weight gain. Lower mortality rate was recorded in broiler chickens fed diet containing 750 g/100Kg diet of *Canarium schweinfurthii* compared to birds on other dietary treatment.

Table 2: Growth performance of broiler chickens fed diets containing *Canarium schweinfurthii* seed meal (5-8weeks)

Parameters	Levels of <i>Canarium schweinfurthii</i> seed meal (g/100kg)				Oxytet	SEM
	0	250	500	750		
Initial weight (g/b)	737.22	726.28	723.41	721.64	735.08	17.28
Final weight (g/b)	2233.33 ^d	2433.33 ^c	2536.67 ^b	2393.33 ^c	2616.67 ^a	34.44*
Weight gain (g/b)	1496.11 ^d	1707.06 ^b	1813.26 ^a	1617.70 ^c	1881.59 ^a	35.23*
Feed intake (g/b)	3068.20 ^b	3367.00 ^b	3566.10 ^a	3315.50 ^b	3663.1 ^a	49.39*
FCR	2.05 ^c	1.96 ^a	1.96 ^{ab}	1.97 ^{bc}	1.94 ^a	0.06*
Feed cost/Kg gain (₦/Kg)	372.03 ^b	358.68 ^a	359.84 ^{ab}	364.06 ^{ab}	364.34 ^a	11.35*
Mortality (%)	33.33 ^a	39.50 ^{ab}	13.58 ^b	7.41 ^b	16.05 ^a	6.44*

abc Means with the same superscripts along the rows are not significantly different (p>0.05), SEM: standard error of means, Oxytet = Oxytetracycline

Carcass characteristics of broiler chickens fed diets containing *Canarium schweinfurthii* seed meal

The carcass characteristics of broiler chickens fed diet containing *Canarium schweinfurthii*

seed meal as phytobiotics is presented in Table 3. There were no significant (P<0.05) differences in all parameters measured except for live, dressed, lung, kidney and liver weights. The results obtained showed that

birds fed dietary supplement of *Canarium schweinfurthii* seed meal and AGPs had higher ($P<0.05$) dressed weight than birds fed control diet, while dressing percentage was ($P<0.05$) higher in birds fed control diet and AGPs. Results of the cut parts showed that there were no significant ($P>0.05$) difference. A report by Alhaji *et al.* (2015) stated that supplementation of photogenic feed additives such as star anise at 1 or 2 g/kg diet of broiler chickens improved body weight, daily weight gain and feed conversion ratio. A report by Yang *et al.* (2009) stated that the use of antibiotics growth promoter has the ability to improve weight gain and carcass yield of birds which is in line with this study. The result of this study showed that dressed weight and dressing percentage were higher

($P<0.05$) in birds fed diet supplemented with Oxytetracycline. However, in this study there was no observed significant improvement in carcass yield of broiler chickens fed diets containing *Canarium schweinfurthii* seed meal. This result contradicts the report of Tazi *et al.* (2014) who stated that broiler chickens fed diets supplemented with PFA (black pepper) had significantly higher values for body weight gain, feed conversion ratio and organ weights (breast, drumstick and thigh). This result is consistent with earlier studies (Hassan *et al.*, 2018; Amad *et al.* 2013) that phytobiotics inclusion in diets of broiler chicken had no significant ($P>0.05$) impact on liver, heart and gizzard percents as a proportion of live weight of broiler chickens.

Table 3: Carcass characteristics of broiler chickens fed diets containing *Canarium schweinfurthii* seed meal

Parameters	Levels of <i>Canarium schweinfurthii</i> seed meal (g/100kg)				Oxytet	SEM
	0	250	500	750		
Live weight (g)	2233.33 ^d	2433.33 ^c	2536.67 ^b	2393.33 ^c	2616.67 ^a	34.44*
Dressed weight (g)	1587.95 ^b	1712.25 ^b	1765.07 ^b	1591.54 ^b	1902.41 ^a	96.42*
Dressing (%)	71.11	70.38	69.55	66.50	72.66	3.51
Breast (%)	30.12	30.68	28.30	30.87	31.91	1.99
Back (%)	16.47	17.59	17.34	18.01	17.64	0.87
Thigh (%)	15.44	15.58	14.74	14.99	15.77	1.03
Drumstick (%)	13.90	14.36	13.55	13.90	14.41	0.93
Wing (%)	11.96	12.93	11.81	12.59	11.02	0.84
Gizzard (%)	2.13	2.48	2.16	2.30	2.27	0.19
Heart (%)	0.57	0.56	0.53	0.52	0.55	0.06
Lungs (%)	0.51 ^b	0.59 ^b	0.63 ^{ab}	0.56 ^b	0.77 ^a	0.08*
Kidney (%)	0.55 ^c	0.68 ^b	0.80 ^a	0.57 ^{bc}	0.65 ^b	0.06*
Liver (%)	1.62	1.63	1.85	1.82	1.85	0.21

abc Means with the same superscripts along the rows are not significantly different ($p>0.05$), SEM: standard error of means, Oxytet = Oxytetracycline

Conclusion and Recommendation

Canarium schweinfurthii (Black olive) seed meal inclusion in broiler chickens’ diets at 500 g/100kg diet significantly improved growth performance and carcass characteristics with no detrimental effect on

broiler chickens. It is recommended that *Canarium schweinfurthii* should be included at 500 g/100kg diet for optimum performance.

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