

GROWTH PERFORMANCE AND ECONOMY OF PRE-STARTER, STARTER AND FINISHER BROILER CHICKENS FED DIET WITH *Sacoglottis gabonensis* BARK MEAL

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ABSTRACT

The experiment was carried out to examine the effect of *Sacoglottis gabonensis* bark meal (SGBM) on the growth performance of pre starter, starter and finisher of broiler chickens. A total of one hundred and 50-day old cobb 500 chicks were randomly assigned to five dietary treatment containing 30 chicks each. Each treatment was replicated three times with ten birds each. The experiment was arranged in a completely randomized design (CRD). Five diets were formulated to represent (T1-T5), Treatment 1(T1) served as the control diet containing no SGBM, while T2,T3,T3 and T5 contained 0.5,1.0,1.5 and 2.0 % respectively. The formulated diets were fed to the birds from the pre starter phase(week1-3) through the starter phase (week 4-5) and the finisher phase (week 6-8). There were no significant($p<0.05$) differences on the growth parameters measured at the pre starter, starter and finisher phase during the experiment. The economic analysis shows at the pre starter stage, cost of feed intake/kg body weight gain was significantly lower (1230.53) at 1.0% and (1266.85) at 0.5% inclusion of SGBM each but for the starter phase there were no significant($p<0.05$) differences in the economic indices across the various treatments. From the findings of this study, up to 2.0% SGBM can be incorporated into broilers pre starter and starter diets to improve body weight and for economic gains.

Keywords: Broiler chickens, Growth performance, Economy, *Sacoglottis gabonensis*, Bark meal
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INTRODUCTION

In Nigeria today, poultry production has gain a lot of popularity in the livestock industry. The popularity of the poultry sector in the world according to FAO (2017) is approximately 90 billion metric tons annually. Protein intake of Nigerians has been reported to have fallen below the FAO recommendation which for crop is 70g /capital/head/day and that of animal origin to be 35g /capital /day but according to

Adewumi, *et al.*, (2010), Nigerians consumed 9.3g /day as against the 35g /capital/day recommendation. The low consumption of protein from animal origin in the view of Adewumi, *et al.*, (2010) can be attributed to low animal production in Nigeria. The low production experience in the livestock sector is influenced by several factors which include scarcity of feed resources, high cost of production rising from the high cost of feed ingredient, poor utilization of feed, diseases

outbreaks. (Hafez and Attia, 2020; Omolere and Alagbe, 2020).

Nutrition is an important factor that influences the growth rate of the animal and this can be influenced by access to quality feed which is very crucial to the success of the animal industry generally and particularly the poultry industry but unfortunately the sector in recent years have been facing difficulties in addressing the various challenges undermining it (Lo *et al.*, 2009).

If Nigeria aims at breaching the nutrition gap from animal sources, there is need to invest more in poultry sector especially the exotic breeds of broilers which are known for fast growth. Broiler chickens have good feed conversion ratio and for this reason are mainly produced for meat and are characterised with faster growth, making them an ideal subject for nutritional studies (Habibu *et al.* 2020).

Research has shown that the demand for poultry products has increased since chicken meat has more nutritional and health benefits than meat from other animals like beef and mutton due to its high level of beneficial unsaturated fatty acids (Erinle and Adewole, 2022).

Amongst the list of the consumption of poultry meat, Rouger *et al.* (2017) reported that broiler chicken is top on the list. The interest in broiler meat has challenged poultry (broilers) producers to continually seek ways of enhancing the productivity of safe and quality poultry products that would meet the needs of the consumers.

Nemauluma *et al.* (2022) reported that farmers include antibiotics into animal feed in order to enhance growth while cutting the cost of production.

The use of these antibiotics has been reported to be associated with antibiotics resistance as residues have been traced to various animal products (Masud *et al.*, 2020). The search for alternative means of enhancing growth, reduced cost production

and overall wellbeing of livestock has ignited the interest of researchers on medicinal plant as additives. Plant additives have proven to be a viable alternative because they are less toxic, and have little or no residual effects on the birds and the consumers of these products. (Krysiak *et al.*, 2021).

Additives from plants origin has been identified to contain numerous bioactive compounds, including phytochemicals, essential oils, and antioxidants, which have been identified to have positive effects on animal health (Diniz do Nascimento *et al.*, 2020; Bansal and Priyadarsini, 2022). Other potentials are antimicrobial, immunomodulatory, anti-inflammatory, and growth-promoting properties. (Onyenibe *et al.*, 2023; Abd El-Hack *et al.*, 2022; Lillehoj *et al.*, 2018).

Sacoglottis gabonensis (Bitter bark) tree is one of the various plants that abound in most countries in Africa including Nigeria which the southern region is fortunate to harbor this plant especially around the coast in rain forest zone, fresh water swamp forest, riverbanks and edges of lagoons. *Sacoglottis gabonensis* is a plant that is full of potentials but with little research carried out on the various parts of the plant. To evaluate and fully utilize the potentials of this plant in the poultry industry, it is important that more researches be carried out on the different part, therefore the reasons why this research is considering the use of *Sacoglottis gabonensis* bark meal as an additive in broiler meal.

MATERIALS AND METHODS

Experimental site

The study was carried out at the Teaching and Research farm of the Department of Animal Science, University of Uyo, Uyo, Nigeria. Uyo lies between latitude 4°31'N and 5°03'N and longitude 7°31'E and 8°03'E. The altitude of the area is 38 m above sea level and a mean rainfall of 2000 mm (Meteorology Station, University of Uyo,

Uyo, Nigeria).

Procurement and Processing of Test Materials

Fresh bark of *S. gabonensis* was purchased from Ikot Ambang market, Uyo, Akwa Ibom State. The bark was scrapped, washed to remove dirt and sand after which it was air dried at room temperature for a week, milled and stored in an air tight container until use.

Experimental Diets

Five experimental diets each were formulated, as shown below, for the pre-

starter (0-3 weeks), starter (4-5 weeks) and finisher (6-8 weeks) phases of the broiler chickens

Treatment 1: Diet without *S. gabonensis* stem bark served as the control

Treatment 2: Diet with 5 g/kg of feed (0.5%)

Treatment 3: Diet with 10 g/kg of feed (1%)

Treatment 4: Diet with 15 g/kg of feed (1.5%)

Treatment 5: Diet with 20 g/kg of feed (2.0%)

Broilers diets contained maize, soya bean meal, palm kernel cake, wheat offal, SGBM, fish meal, palm oil, bone meal, lysine, methionine, salt and vitamin premix as presented in Tables 1, 2 and 3.

Table 1: Ingredient Composition of Experimental Diets with SGBM Fed to Pre Starter Broiler Chicken (0-3 weeks)

Treatment	1	2	3	4	5
Levels of SGBM(%)	0	0.5	1.0	1.5	2.0
<i>Ingredients</i>					
Maize	57.00	58.00	58.00	57.00	57.00
Soya bean meal	31.00	31.00	31.00	31.00	30.00
Palm Kernel Cake	1.5	0.8	0.4	1.0	0.9
Wheat Offal	1.5	0.5	0.5	0.3	0.8
Fish Meal	4.00	4.00	4.00	4.00	4.00
Palm Oil	1.0	1.2	1.1	1.2	1.3
Bone Meal	3.00	3.00	3.00	3.00	3.00
SGBM	0	0.5	1	1.5	2.0
Salt	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
<i>Calculated Nutrient Composition:</i>					
Crude Protein	23.1	23.1	23.0	23.1	23.0
Metabolizable Energy	3200	3201	3201	3197	3198
Crude Fibre	3.19	3.20	3.27	3.43	3.54
Ether Extract	7.56	7.56	7.89	7.57	7.56
Calcium	1.47	1.48	1.47	1.48	1.48
Phosphorous	0.78	0.77	0.77	0.77	0.77
Methionine	0.35	0.35	0.36	0.36	0.37
Lysine	1.14	1.14	1.15	1.16	1.17

1 kg of premix contains: Vitamin A (5,000,000 IU), vitamin D3 (1,000,000 IU), vitamin E (16,000 mg), vitamin K3 (800 mg), vitamins B₂ (22,000 mg), Niacin (22,000 mg), Vitamin B₁₂ (10 mg), Folic Acid (400 mg) Biotin (32 mg), Chlorine chloride (200,000 mg), Zinc (32,000 mg) Iodine (600 mg), Cobalt

Table 2:Ingredient Composition of Experimental Diets with SGBM Fed to Broiler Starter Chicken (4-5 weeks)

Treatment	1	2	3	4	5
Levels of SGBM (%)	0	0.5	1.0	1.5	2.0
<i>Ingredients:</i>					
Maize	59.00	59.00	58.00	58.00	58.00
Soya bean meal	31.00	30.00	30.00	31.00	30.00
Palm Kernel Cake	1.5	1.6	1.6	1.4	1.2
Wheat Offal	1.6	1.5	1.5	1.3	1.0
Fish Meal	2.0	2.0	2.0	2.0	2.0
Palm Oil	1.5	1.5	1.7	1.7	1.5
Bone Meal	3.00	3.00	3.00	3.00	3.00
SGBM	0	0.5	1	1.5	2.0
Salt	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
<i>Calculated Nutrient Composition:</i>					
Crude Protein	20.3	20.1	20.2	20.4	20.1
Metabolizable Energy	3199	3200	3208	3199	3198
Crude Fibre	3.16	3.28	3.37	3.44	3.50
Ether Extract	7.39	7.39	7.74	7.39	7.42
Calcium	1.54	1.54	1.54	1.54	1.54
Total Phosphorous	0.79	0.79	0.79	0.79	0.79
Methionine	0.32	0.33	0.33	0.34	0.34
Lysine	1.03	1.04	1.04	1.05	1.06

1 kg of premix contains: Vitamin A (5,000,000 IU), vitamin D3 (1,000,000 IU), vitamin E (16,000 mg), vitamin K3 (800 mg), vitamins B₂ (22,000 mg), Niacin (22,000 mg), Vitamin B₁₂ (10 mg), Folic Acid (400 mg) Biotin (32 mg), Chlorine chloride (200,000 mg), Zinc (32,000 mg) Iodine (600 mg), Cobalt (120 mg), Selenium (40 mg), antioxidant (48,000 mg).

Experimental Birds

A total of one hundred and fifty (150) day old chicks were randomly assigned to five dietary treatment with three replicate of 10 birds per replicates. The pen was pre warm before the arrival of the chicks and on arrival, the chicks were given glucose to cushion the effect of stress on the birds. Feed and water were served *ad libitum* throughout the experiment. Heat was provided by using kerosene stove and electric bulb to keep them warm throughout the brooding phase and the birds were housed in a well ventilated pen with deep litter system. The vaccination

schedule was strictly followed according to international standard.

Data Collection

The initial body weight (g/bird) was determine before the administration of experimental treatments.

Daily feed intake was measured as the difference between the daily feed served and the feed left over. Weekly live body weight was measured using a 20 kg capacity scale.

Body weight gain was calculated as the difference between the final body weight

and the Initial body weight divided by the number of birds per replicate.

Metabolizable Energy (ME) was calculated as ME in feed multiplied by the feed intake while Daily metabolizable energy is the ratio of ME to the total number of days Metabolizable Energy efficiency is the ratio of the weight gain to the ME intake, while the

Feed conversion ratio (FCR) was calculated as the ration of the feed intake to the body weight gain of the birds.

Protein intake = % CP of feed × feed intake

Protein efficiency was calculated as the ratio of the weight gain to the protein intake.

Table 3: Ingredient Composition of Experimental diets with SGBM fed to Broiler Finisher Chicken (6-8 weeks)

Treatment	1	2	3	4	5
Levels of SGBM (%)	0	0.5	1.0	1.5	2.0
<i>Ingredients</i>					
Maize	64.00	64.00	64.00	65.00	65.00
Soya bean meal	26.00	26.00	26.00	25.00	24.00
Palm Kernel Cake	0.90	0.50	0.50	0.20	0.70
Wheat Offal	0.90	0.50	0.50	0.20	0.50
Fish Meal	2.0	2.0	2.0	2.0	2.0
Palm Oil	1.3	1.3	1.3	1.3	1.3
Bone Meal	3.50	3.50	3.50	3.50	3.50
SGBM	0	0.5	1	1.5	2.0
Salt	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
<i>Calculated Nutrient Composition:</i>					
Crude Protein	18.7	18.9	18.8	18.5	18.5
Metabolizable Energy	3205	3202	3205	3205	3199
Crude Fibre	2.93	3.00	3.05	6.79	6.66
Ether Extract	6.90	6.90	6.80	7.39	7.42
Calcium	1.53	1.53	1.53	1.53	1.53
Total Phosphorous	0.77	0.77	0.77	0.77	0.7
Methionine	0.31	0.31	0.32	0.33	0.32
Lysine	0.93	0.94	0.94	0.93	0.92

1 kg of premix contains: Vitamin A (5,000,000 IU), vitamin D3 (1,000,000 IU), vitamin E (16,000 mg), vitamin K3 (800 mg), vitamins B₂ (22,000 mg), Niacin (22,000 mg), Vitamin B₁₂ (10 mg), Folic Acid (400 mg) Biotin (32 mg), Chlorine chloride (200,000 mg), Zinc (32,000 mg) Iodine (600 mg), Cobalt

Cost of feed per kg = summation of price of feed ingredients(kg) × $\frac{\text{ingredient proportion in feed}}{100}$

Cost of feed intake/kg body weight gain was calculated as the cost of feed per kg feed

multiplied by the FCR. Cost of feed intake per bird = cost/kg feed × feed intake

Data Analysis

Data obtained from the study were subjected to one-way analysis of variance

(ANOVA) using SPSS software while Duncan's Multiple Range Test of the same software was used for separation of the means.

RESULTS AND DISCUSSION

The result of the growth performance of pre starter broilers fed dietary SGBM is presented in table 4. From the result, there were no significant differences recorded for all the growth parameters measured at this phase except for cost of feed intake/kg BWG which a significantly higher cost (1402.90) was obtained in the control though not significantly different from 1348.37 and 1344.55 recorded at 1.5% and 2.0% respectively but significantly different from 1230.53 which was the lowest cost at 1.0% and 1266.85 at 0.5% each. The result equally shows a higher significant difference in values obtained for the cost of feed

intake/bird at the control (820.80) as against 699.83(0.5%), 734.23(1.0%), 736.87(1.5%) and 761.17 (2.0%) which were not significantly different from each other.

The lower cost of feed intake /kg body weight gain and lower cost of feed intake /bird can be attributed to the ability of the birds to efficiently utilize a smaller quantity of feed taken and converting it to higher body weight thereby lowering the cost. The report from Hammoud *et al.*, (2019) that there were no significant differences in the values obtained for final body weight, cumulative weight gain, FCR and total feed intake of broiler chicks fed diet containing varying levels of oak bark powder at the pre-starter phase aligns with the result obtained in this present study, this indicates that SGBM did not have any influence on the growth of broiler at the pre-starter stage.

Table 4: Growth Performance and Economy of Pre-Starter broiler Chickens (0-3week) Fed Varying Dietary Levels of SGBM

Treatment	1	2	3	4	5	SEM	P Value
Levels of SGBM (%)	0	0.5	1.0	1.5	2.0		
<i>Performance Parameters:</i>							
Initial Body Weight (g)	45.63	45.47	46.03	46.00	47.43	0.30	0.265
Daily Feed Intake (g)	46.71	45.60	46.97	46.49	47.09	0.39	0.826
Total Feed intake	981.0	957.6	986.4	976.3	988.8	8.28	0.825
Daily BWG (g)	27.92	26.31	28.44	26.26	27.03	0.44	0.484
Final Body Weight (g)	632	598	643.3	597.3	615	9.46	0.494
FCR	1.68	1.73	1.65	1.77	1.74	0.02	0.391
Total Protein Intake	215.8	210.7	217.0	214.8	217.5	1.82	0.825
Daily Protein Intake (g)	10.03	10.03	10.33	10.22	10.35	0.09	0.825
Protein Efficiency	2.71	2.62	2.76	2.57	2.68	0.03	0.453
ME Intake (kcal)	3139.2	3064.2	3156.7	3124.2	3164.3	26.51	0.825
Daily ME Intake (kcal)	149.4	145.9	150.3	148.8	150.7	1.26	0.827
ME Efficiency	0.183	0.18	0.19	0.17	0.18	0.003	0.377
Cost of Feed /Kg	836.7	730.9	744.3	754.7	769.8	9.89	-
Cost of FI/kg BWG	1402.9 ^a	1266.8 ^{bc}	1230.5 ^c	1348.4 ^{ab}	1344.5 ^{ab}	20.95	0.032*
Cost of FI/ Bird (₦)	820.8 ^a	699.8 ^c	734.2 ^{bc}	736.9 ^{bc}	761.2 ^b	12.2	0.003**

SGBM = *Sacoglottis gabonensis* bark meal; SEM = Standard error of mean; BWG = Body weight gain; FCR = Feed conversion ratio; ME = Metabolizable energy; FI = Feed intake. * = Significant ($p < 0.05$); ** = Highly significant ($p < 0.01$).

The result of the effect of *Sacoglottis gabonensis* bark meal on starter broiler chicken is as presented in Table 5. There were no significant ($p>0.05$) differences observed in all the growth indices of starter broiler but numerically, the highest final body weight (1018.33g), daily protein intake (13.766g), protein efficiency (2.180), metabolizable energy intake (3027.33) was obtained with 1.5% inclusion of the test diet compared to the least daily protein intake(12.266g) and metabolizable energy intake(2707.00g) observed in the control. The highest metabolizable efficiency value (0.1367) was obtained in the control while the lowest (0.1200) was recorded at 1.0%.

The experiment by Ayoola *et al.* (2020) with *Mangifera indica* and *Azadirachta indica* bark extract through

maceration on broiler starter, showed a higher final weight (764.52g) in the control group though not significantly ($p>0.05$) different from the group treated with *Azadirachta indica* with final weight(738.02g) and 760.32g from the *Mangifera indica* treated group. The control group equally had higher values for total weight gain(722.46g), daily weight gain(25.80g), total feed intake(1605.78g) and daily feed intake(57.35g) but with no significant differences with *Mangifera indica* treated group in the value obtain for total weight gain(719.31g), daily weight gain (25.69g) and the least FCR (2.20). The *Azadirachta indica* treated group had the lowest total weight gain (698.88g), daily weight gain (24.89g) and the highest FCR (2.31).

Table 5: Growth Performance and Economy of Starter broiler Chickens(4-5week) Fed Varying Dietary Levels of SGBM

Treatment	1	2	3	4	5	SEM	P value
Levels of SGBM (%)	0	0.5	1.0	1.5	2.0		
<i>Performance Parameters:</i>							
Initial Body Weight(g)	632.0	598.0	643.33	597.33	615.0	9.46	0.453
Daily Weight Gain (g)	26.80	28.13	26.50	28.30	27.60	1.24	0.992
Final Body Weight (g)	1007.66	991.66	1014.0	1018.3	1002.0	18.92	0.996
FCR	2.273	2.38	2.453	2.388	2.363	0.15	0.915
Daily Protein Intake (g)	12.27	12.90	13.17	13.77	12.90	0.13	0.726
Protein Efficiency	2.176	2.136	2.020	2.1800	2.116	0.07	0.932
ME Intake (kcal)	2707	2875.7	2925.1	3027.3	2890.3	68.79	0.748
Daily ME Intake (kcal)	193.4	205.4	208.9	216.2	206.4	4.91	0.749
ME Efficiency	0.137	0.127	0.120	0.133	0.127	0.01	0.754
Cost (₦) of FI/kg BWG	1536.00	1643.79	1720.20	1693.54	1719.42	48.87	0.775
Cost (₦) of FI/Bird	571.83	620.68	639.23	671.69	657.45	16.57	0.927

SGBM = *Sacoglottis gabonensis* bark meal; SEM = Standard error of mean; BWG = Body weight gain; FCR = Feed conversion ratio; ME = Metabolizable energy; FI = Feed intake.

The effect of the inclusion of SGBM in the diet of broiler finisher is presented in Table 6. The result showed no significant($p>0.05$) differences in the growth parameters measured but numerically, the highest final body weight (1840.66g), daily feed intake (85.96g) daily protein intake (15.90), metabolizable energy intake

(5786.0) was observed at 1.5% inclusion of SGBM and the lowest values for final body weight (1614.66g), daily feed intake (66.74g), daily protein intake (12.48), protein efficiency (2.23), metabolizable energy intake (4492.66), metabolizable energy efficiency (0.1300) was obtained in the control. The highest final weight gain

(1840.66g) obtained in this work with SGBM is similar to the final weight gain obtain by Ayoola *et al.* (2020) in the control diet (1846g), *Mangifera indica* bark extract(1847g) and *Azadirachta indica* bark extract (1825.62g).

However, the daily feed intake in this present studies was found to be lower(85.96g) than what was reported with *Mangifera indica* bark extract (119.63g) and *Azadirachta indica* bark extract (118.55g) and their control (115.91g). The FCR recorded for *Mangifera indica* bark extract (3.08) and *Azadirachta indica* bark extract (3.07) while their control (3.01) were all

higher than (2.35) which was the highest at the control(0%SGBM) with the least value (1.88) observed at 2.0% showing the birds performed better with SGBM diet. In line with this present work, Ayoola *et al.* (2020) reported that there were no significant differences in all the growth parameters measured at the finisher phase. The cost analysis at this phase indicates that cost of feed /kg was highest at 2.0% inclusion of dietary SGBM, this might be due to the cost of purchasing the test ingredient (*Sacoglottis gabonensis*) which partly replaced some ingredient in the feed.

Table 6: Growth Performance and Economy of Finisher broiler Chickens(6-8week) Fed Varying Dietary Levels of SGBM

Treatments	1	2	3	4	5	SEM	P value
Levels of SGBM (%)	0	0.5	1.0	1.5	2.0		
<i>Performance</i>							
<i>Parameters:</i>							
Initial Body Weight (g)	1007.66	991.66	1014.0	1018.33	1002.0	18.91	0.996
Daily FI (g)	66.74	75.90	72.01	85.96	69.26	4.13	0.684
Daily BWG (g)	28.90	35.13	37.42	39.16	38.63	2.38	0.714
Final Body Weight (g)	1614.7	1729.7	1800	1840.7	1813.3	58.89	0.809
FCR	2.35	2.14	2.03	2.18	1.88	0.106	0.765
Daily Protein Intake (g)	12.48	14.34	13.53	15.90	12.80	0.770	0.702
Protein Efficiency	2.23	2.47	2.83	2.48	2.96	0.145	0.067
ME Intake (kcal)	4492.66	5104.0	4848.1	5786.0	4653.66	278.38	0.682
Daily ME (kcal)	213.96	243.00	230.85	275.52	221.60	13.25	0.682
ME Efficiency	0.1300	0.1400	0.1633	0.1367	0.1667	0.008	0.644
Cost (₦) of FI/kg BWG	1600.86	1486.21	1436.28	1578.18	1380.51	72.70	0.898
Cost of F I/Bird (₦)	952	1105.29	1070.71	1301.96	1064.40	63.20	0.578
Feed cost /kg	679.29 ^c	693.41 ^d	707.83 ^c	721.73 ^b	731.72 ^a	5.044	0.0001

SGBM = *Sacoglottis gabonensis* bark meal; SEM = Standard error of mean; BWG = Body weight gain; FCR = Feed conversion ratio; ME = Metabolizable energy; FI = Feed intake.

CONCLUSIONS

- Inclusion of *Sacoglottis gabonensis* bark meal up to 2.0% in to the diets of pre-starter, starter, finisher broiler chicken had no negative influence on their growth performance.
- The incorporation of dietary SGBM at the pre-starter phase significantly reduced the cost of feed intake/kg body weight gain.

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