



PERFORMANCE AND ECONOMIC BENEFITS OF BROILER CHICKENS FED DIETARY LEVELS OF SICKLE POD (*CASSIA TORA*) AND SUNFLOWER SEED MEAL

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ABSTRACT

The study was conducted to evaluate the performance and economic benefits of broiler chicken production using sickle pod seed (*cassia tora*) and sunflower seed meals based diets. Five diets each for both starter (23% CP) and finisher (20% CP) were formulated in which *Cassia tora* meal replaced sunflower meal at 0, 20, 30, 40 and 50% levels coded as diets A, B, C, D and E respectively. Three hundred (300) day old broiler chicks were randomly allocated to the five diets in four replicates of fifteen birds each. The experimental diets and water were supplied to the birds *ad libitum* and the research lasted for seven weeks. Daily feed intake and body weight changes were taken across the replicates on daily and weekly basis respectively. The result indicted that only final weight was significantly ($P<0.001$) affected by the dietary levels of *Cassia tora*. At the starter phase, daily feed intake (71.57 – 85.44g), daily weight gain (17.11 - 24.17g) and feed conversion ratio (3.32 - 3.88) were not influenced by the dietary treatments. At the finisher phase however, daily feed intake (106.91-135.50g) and feed conversion ratio (2.70-4.27) were significantly ($P<0.001$) affected by the levels of *Cassia tora* in the diets whereas no significant difference was found on daily weight gain (30.81-43.26). The overall phase showed significant difference ($P<0.001$) for feed conversion ratio with values ranging between 3.06-4.08 on diets 3 and 4 respectively. It was concluded that sickle pod (*Cassia tora*) seed meal can replace sunflower seed meal at 30% level in the diets of broiler chickens with no detrimental effects on growth performance with economic advantage in reducing feed cost by 17.71%. Therefore, 30% of sickle pod seed meal is recommended for use in broiler chicken diets.

Keywords: Broiler, Performance, Sickle, Pod, Sunflower, Diets

INTRODUCTION

Shortages and increasing cost of conventional protein sources continue to affect poultry production. Soya bean and groundnut cake have traditionally been the main protein sources in poultry feeds, but with the growth of the sector and the world's population, they are failing to meet the increasing demand (Frempong *et al.*, 2019). For this reason, poultry products have been inadequate with subsequent increase in their prices. A possible way to reduce poultry feed costs is finding alternatives to conventional protein sources that are inexpensive, efficient and locally available. Nigeria with low per caput animal protein consumption qualifies as one of the less developed countries in which the animal protein consumption has consistently declined in recent years. The trend is sequel to the decline in livestock production occasioned by the high cost of feed materials which account for about 70-80% of the cost of production (Ogbuewe *et al.*, 2019). The cost of feed is also attributed to the competition between man and livestock for the available grain and the government policies militating against feed importation (Okachukwu, 2015). Consequently, more than 50% of poultry farms have closed and about 30% forced to reduce their production capacity due to scarcity of feed ingredients (Esonu, *et al.*, 2001. Kwari *et al.*, 2023). Several unconventional legume seeds such as pigeon pea, sword beans and mucuna species have been studied and evaluated for inclusion in the livestock diets in Nigeria. Other unconventional legume seeds that are still underutilized and little is known about their chemical composition and nutritional values include sickle pod (*Cassia tora*), bambara nut and sunflower seeds.



METHODOLOGY

Experimental Site

The research was conducted at the poultry unit of Teaching and Research farm of the Federal College of Horticulture (FCH) Dadin kowa, Gombe State, Nigeria. Dadin kowa is in the North-Eastern Agro-ecological zone of Nigeria in the humid tropical area of West Africa and is situated at 10.3145°N 11.5308°E with altitude of 240 meters above sea level and has temperature of about 24°C-40°C with mean annual rainfall of about 960- 1110 millimeters, and relative humidity is about 38°C - 50°C all year round (FCH 2022).

Experimental Diets

Five experimental diets each for both starter (23% CP) and finisher (20% CP) were formulated in which *Cassia tora* meal replaced sunflower meal at 0, 20, 30, 40 and 50% coded as diets A, B, C, D and E respectively. Other ingredients used were maize, soyabean, fishmeal, wheat offal, bone meal, limestone, salt, vitamin/mineral premixes, methionine and lysine. The ingredients and percentage composition of the diets are presented in Tables 1 and 2.

Table 1: Ingredients and Percentage Compositions of *Cassia tora* and Sunflower Seeds Meal Diets Fed to Starter Broiler Chickens (2-4 Weeks)

Diets					
Ingredients	A (0%)	B (20%)	C (30%)	D (40%)	E (50%)
Maize	47.00	47.00	47.00	47.00	47.00
Full fat soyabean	14.00	14.00	14.00	14.00	14.00
Sunflower seed	20.00	16.00	14.00	12.00	10.00
<i>Cassia tora</i>	0.00	4.00	6.00	8.00	10.00
Fish Meal	5.00	5.50	6.00	6.50	7.00
Wheat Offal	10.00	9.50	9.00	8.50	8.00
Bone Meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.30	1.30	1.30	1.30	1.30
Salt	0.25	0.25	0.25	0.25	0.25
Premix*(starter)	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	1.10	1.10	1.10	1.10
Total	100	100	100	100	100

Calculated Analyses (%)

M. E. (Kcal/kg)	2818.30	2831.18	2844.07	2856.95	2869.84
Crude Protein	23	23	23	23	23
Crude Fibre	5.94	5.78	5.62	5.46	5.30
Ether Extract	3.38	3.40	3.42	3.45	3.47
Calcium	1.36	1.37	1.39	1.38	1.38
Phosphorus	1.05	1.08	1.12	1.15	1.19
Methionine	0.41	0.42	0.43	0.44	0.45
Lysine	0.72	0.80	0.88	0.96	1.04

*Vit/Mineral Premix Supplied/Kg of Diet: Vit A, 12500 IU, Vit D3 2500 IU; Vit E, 30IU; Vit K, 2.5 Mg, Riboflavin, 6mg, Pantothenic Acid, 10mg; Vit B2, 4mg; Niacin, 20mg; Vit B₁₂, 22mg; Biotin, 0.75mg; Folic Acid, 0.5mg; Vit B6, 1.5mg; Vit B, 1.6mg; Choline Chloride, 175mg; Cobalt, 0.2mg; Copper 3mg; Iodine, 1mg; iron, 20mg; Manganese, 40mg; Selenium, 0.2mg; Zinc 20mg, Antioxidant 1.25mg

Table 2: Ingredients and Percentage Compositions of *Cassia tora* and Sunflower Seed Meal Based Diets Fed Finisher Broiler Chickens (5-7 Weeks)

Ingredients	Diets				
	A (0%)	B (20%)	C(30%)	D(40%)	E(50%)
Maize	52.70	52.70	52.70	52.70	52.70
Full fat soya bean meal	8.00	8.00	8.00	8.00	8.00
Sunflower Seed	20.00	16.00	14.00	12.00	10.00
<i>Cassia tora</i>	0.00	4.00	6.00	8.00	10.00
Fish Meal	2.00	2.00	2.00	2.00	2.00
Wheat Offal	13.30	13.00	13.00	13.00	13.00
Bone Meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.30	1.30	1.30	1.30	1.30
Salt	0.25	0.25	0.25	0.25	0.25
Premix*(finisher)	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated Analyses (%)					
M. E. (Kcal/kg)	2892.01	2904.86	2917.62	2930.47	2943.23
Crude protein	20	20	20	20	20
Crude fibre	5.44	5.34	5.18	5.05	4.92
Ether extract	3.28	3.27	3.34	3.37	3.40
Calcium	1.5	1.5	1.5	1.5	1.5
Phosphorus	0.88	0.88	0.89	0.89	0.89
Methionine	0.45	0.46	0.46	0.46	0.47
Lysine	0.71	0.77	0.83	0.88	0.94

Vit/Mineral Premix Supplied/Kg of Diet: Vit A, 12500 IU, Vit D3 2500 IU; Vit E, 30IU; Vit K, 2.5 Mg, Riboflavin, 6mg, Pantothenic Acid, 10mg; Vit B2, 4mg; Niacin, 20mg; Vit B₁₂, 22mg; Biotin, 0.75mg; Folic Acid, 0.5mg; Vit B6, 1.5mg; Vit B, 1.6mg; Choline Chloride, 175mg; Cobalt, 0.2mg; Copper 3mg; Iodine, 1mg; Iron, 20mg; Manganese, 40mg; Selenium, 0.2mg; Zinc 20mg, Antioxidant 1.25mg.

Experimental Birds and their Management

A total of 300 unsexed day old broiler chicks were used for the study. Prior to their arrival, both the brooding and rearing houses were cleaned and disinfected. On arrival the birds were served with oral dose of glucose and multivitamin to reduce stress on transit. They were brooded for one week during which charcoal and electric bulbs were used to provide heat and light when needed. Commercial feed and water were adequately supplied. At the end of the brooding period, birds were randomly allocated to the five dietary treatments in four replicates of 15 chicks in a completely randomized design. The floor was covered with a wood shavings throughout the period of the research. Experimental feeds and water was served *ad libitum*. All necessary routine management practices were strictly adhered to, and the experiment lasted for fifty six (56) days (28 and 21 days for starter and finisher phases respectively).

Data Collection

Quantity and costs of each ingredient used in the research were obtained. Initial weights and number of birds in each replicate were recorded. Feed Intake (FI) and body weight changes were also taken on daily and weekly basis respectively. Feed conversion ratio (FCR) and feed efficiency (FE) were calculated from the data on FI and DWG. Mortality was recorded as it occurred. Data generated was prepared and analyzed using version 17 MINITAB software.

RESULTS AND DISCUSSION

Growth performance of broiler chickens fed diets containing *Cassia tora* as partial replacement for sunflower seed meal is presented in Table 3.

Table 3: Performance of Broiler Chickens Fed Diets Containing Graded Levels of Sickle – Pod Seed (*cassia tora*) and Sunflower Seed Meals

	Diets					
Parameters	A (0%)	B (20%)	C (30%)	D (40%)	E (50%)	SEM
Productive performance						
Initial weight (g)	152.56	149.	146.78	148.05	145.79	0.88 ^{NS}
Weight at week 4 (g)	757.68	729.36	823.77	727.07	812.43	13.40 ^{NS}
Final weight (g)	1268.30 ^c	1430.30 ^c	1730.50 ^a	1396.60 ^c	1525.90 ^b	22.01 ^{***}
Total weight gain (g)	1127.20	1280.30	1583.60	951.10	1380.10	64.45 ^{NS}
Starter Phase (2-4weeks)						
Daily feed intake (g)	74.98	71.57	84.84	83.13	85.44	2.85 ^{NS}
Daily weight gain (g)	17.11	20.69	24.17	21.57	23.81	1.15 ^{NS}
Feed conversion ratio	3.61	3.50	3.32	3.88	3.72	0.16 ^{NS}
Mortality (Number)	0	1	1	0	0	
Finisher phase (5-7 weeks)						
Daily feed intake (g)	106.91	110.61	124.83	135.50	125.50	1.92 ^{***}
Daily weight gain (g)	31.38	39.65	43.26	30.81	35.72	2.21 ^{NS}
Feed conversion ratio	3.58	3.28	2.70	4.27	3.46	0.14 ^{***}
Mortality (number)	0	0	1	2	1	
Overall Phase (2-7 weeks)						
Daily feed intake (g)	92.18	91.08	102.34	116.32	106.18	2.93 ^{NS}
Daily weight gain (g)	26.51	28.18	33.68	26.19	22.15	1.65 ^{NS}
Feed conversion ratio	3.61	3.39	3.06	4.08	3.53	11.22 ^{***}
Mortality (Number)	0	1	2	2	1	

abc=Means bearing different super script within the same row differ ***= (P<0.001)NS = Not significant, SEM = Standard Error of the Means.

Among the productive performance parameters initial weight, week 4 weight, final weight and total weight gain were not affected except final weight that was significantly ($P<0.001$) affected by the dietary levels of *Cassia tora*. Similarly at the starter phase, daily feed intake (71.57 – 85.44), daily weight gain (17.11 - 24.17) and feed conversion ratio (3.32 - 3.88) were not influenced by the dietary treatments. Values on daily weight gain were higher than those obtained by Isa *et al* (2024a) and Amaza *et al.* (2020) on replacing *Cassia tora* seed meal with full fat soya bean in broiler diets. At the finisher phase however, daily feed intake (106.91-135.50) and feed conversion ratio (2.70-4.27) were highly ($P<0.001$) affected by the levels of *Cassia tora* in the diets whereas no significant difference ($P>0.05$) was found on daily weight gain (30.81-43.26). This result differ with the values obtained by Augustine *et al.* (2017) and Isah *et al.* (2024b). At the overall phase, high significant difference ($P<0.001$) was obtained in feed conversion ratio with values ranging between 3.06-4.08 in diets 3 and 4 respectively. This also differ with the findings of Amaza *et al.* (2020) and Assam *et al.* (2017).

Table 6: Cost-Benefit of Broiler Chickens Production Using Graded Levels of Sickle-Pod (*Cassia tora*) Seeds and Sunflower Seed Meals

Diets Parameters	A (0%)	B (20%)	C (30%)	D (40%)	E (50%)
Starter phase (2-4 weeks)					
Total feed intake (kg)	3.67	3.51	4.16	4.07	4.19
Feed cost kg (₦)	294.01	282.44	277.06	272.89	268.11
Total feed cost (₦)	1079.02	991.36	1152.57	1137.95	1123.38
Total weight gain (kg)	0.84	1.01	1.18	1.06	1.17
Feed cost kg gain (₦)	1285.55	981.54	976.75	1073.54	960.15
Cost saving (₦)	303.01	307.80	211.01	324.40	-
Finisher phase (5-7 weeks)					
Total feed intake (kg)	5.24	5.42	6.12	6.59	6.15
Feed cost/kg (₦)	294.01	282.44	277.06	272.89	268.11
Total feed cost (₦)	1540.61	1530.82	1695.61	1798.35	1648.88
Total weight gain (kg)	1.54	1.94	2.12	1.51	1.75
Feed cost/kg gain (₦)	998.45	789.08	799.82	1190.96	942.22
Cost saving (₦)	209.37	198.63	-192.51	56.23	-
Overall phase (2-7 weeks)					
Total feed intake (kg)	4.52	4.46	5.01	5.70	5.20
Feed cost/kg (₦)	294.01	282.44	277.06	272.89	268.11
Total feed cost (₦)	1328.93	1259.63	1388.07	1555.47	1394.17
Total weight gain (kg)	1.30	1.38	1.65	1.28	1.09
Feed cost/kg gain (₦)	1022.25	912.81	841.25	1215.21	1279.06
Cost saving (₦)	-	109.44	181.00	-192.96	-256.81

At the starter phase, total feed intake ranged from 3.51kg on diet B to 4.19kg on diet E, while feed cost ₦/Kg decrease progressively from ₦294.01 on diet A to ₦268.11 on diet E with the increasing *Cassia tora* levels. This observation agrees with Isah *et al* (2024a) who fed broiler chickens with *cassia tora* as replacement to full fat soya bean and Augustine *et al.* (2019) who fed broiler with raw, boiled soaked, sprouted and fermented *cassia tora* seeds as replacement for soya bean meal. This agree with the reported of Elgangy (2024) that unconventional protein sources reduce cost of production as they are obtained at lower costs compared to conventional ones. There was no consistency in the total feed cost, as the feed cost tend to fluctuate from a higher value in one diet and falls in another diet. The values ranged from ₦991.36 in diet B to ₦1152.57 in diet C. Total weight gain (₦/kg) also fluctuates from 0.84kg in diet A (control) to 1.18kg in birds fed diet C (30%). Feed cost ₦/kg gain varied between ₦960.15 on diet E and ₦1284.55 on diet A (control) diet. The cost saving (₦) ranged from ₦211.01 on diet D to ₦224.40 on diet E. This shows that the use of test ingredient to partial replace sunflower seed meal at the starter phase is more economical on diet E (₦324.40). At the finisher phase, the total feed intake (kg) varied between 5.24kg on the control diet to 6.59kg on diet D while feed cost per kg decreased from ₦294.01 on the control diet to ₦268.11 on diet E. Total feed cost fluctuate with increased level of inclusion, the values varied between ₦1530.82 on diet B to ₦1798.35 on diet D. Total weight gain equally fluctuates with increased level of inclusion. The value varied between 1.51kg on diet D to 2.12kg in diet C. Similarly total feed cost ₦/kg gain fluctuate with the increased level of inclusion. The values ranged from ₦789.08 on diet B to ₦1190.96 on diet D. Appreciable cost saving was observed on diet B (₦209.37) followed by diet C (₦198.63) then diet E (₦56.23). At the overall phase, total feed intake similarly fluctuates with increased level of inclusion, just as in the starter and finisher phase. The values varied between 4.46kg on diet B and 5.70kg on diet D. Feed cost decrease with increased in level of inclusion of *Cassia tora*. Diet A (₦294.01) indicated a higher cost, while diet E (₦268.11) indicated a lower cost. The total feed cost tend to fluctuate with increased level of *Cassia tora*, the values ranged from ₦1259.63on diet B to ₦1555.47 on diet D. The total weight gain followed the same trend, diet C (1.65kg) indicated the higher weight gain, while the least weight gain was observed on diet E (1.09kg). Feed



cost ₦/kg gain was much lower on diet C (₦841.25) and highest on diet E (₦1279.06). Diets C (₦181.00) and B (₦109.44) indicated on appreciable cost saving. Whereas it is uneconomical in diets D (₦192.96) and E (₦256.81). This result agrees with that of Abdulazeez *et al.* (2019) who found reduction in feed cost per kg in using unconventional protein sources in broiler chicken diets.

CONCLUSION AND RECOMMENDATIONS

It was concluded that sickle pod (*Cassia tora*) seed meal is a viable alternative protein source in broiler chicken diets and can replace sunflower seed meal at 30% level with no detrimental effects on growth performance with economic advantage by reducing feed cost by 17.71%.

It was recommended that sickle pod (*Cassia tora*) seed meal be used in place of sunflower seed meal up to 30% in broiler chicken diets and further research is recommended for other monogastric species like layers, Japanese quails, turkeys, ducks and rabbits to evaluate the suitability of sickle pod (*Cassia tora*) in their diets.

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