

Effects of Varying Levels of Toasted Cassia Seeds (*Cassia Obtusifolia* L.) As Crude Protein Replacement on the Carcass Characteristics of Noiler Chickens

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Abstract

An experiment was conducted to determine the effect of twenty (20) minutes toasted cassia seed meal as replacement for crude protein on the carcass characteristics of noiler chickens. The cassia seeds were subjected to two processing methods of twenty four (24) hours soaking and twenty (20) minutes toasting period. The raw sample and processed samples were analysed for their anti - nutrient and proximate compositions. Results indicated significant ($P < 0.05$) differences observed in the phytate, oxalate, tannin and saponin content, with the toasted sample having the least values of phytate (18.95 mg/100g), tannin (173.03mg/100g) and saponin (87.90mg/100g). These trend were also observed with results of the proximate analysis, showing the twenty (20) minutes toasted sample having the highest values for the crude protein (11.26 %), crude fiber (7.11 %), ash (1.97 %) and ether extract (4.35 %). The toasted cassia seed sample was then used to formulate six (6) experimental diets for the noiler chickens, with varying inclusion levels of (0.00, 5.00, 10.00, 15.00, 20.00 and 25.00) % both at 0 to 4th and 5th to 8th weeks of age representing the starter and finisher phases respectively. Results for the carcass characteristics showed significant ($P < 0.05$) differences in all the parameters analysed; the 25.00 % inclusion level had the highest carcass weight of (325.46g), while the 5.00 % inclusion level had the highest dressing percent value of (71.37%), for the cut parts, the 5.00 % inclusion level had the highest values of (4.96 %) for the neck, (5.64 %) for the thigh, (3.63 %) for the wing, (4.63 %) for the back, (2.19 %) for the leg, and (10.85 %) for the drum stick. Similar trend were also observed with the organ parts, for the heart (1.07 %), liver (1.85 %), gizzard full (3.31 %), gizzard empty (2.29%), and the intestine weight full (3.91 %). In conclusion, it is recommended that the inclusion of twenty (20.00) minutes

toasted cassia seeds in the feed of noiler chickens at higher levels of 10.00 % and above, does not support the proper development of cut parts and internal organs of the birds.

Key words: Anti-nutrients, Carcass, Cassia seeds, Noiler chickens, Toasted, soaked,

Introduction

Poultry have made great contribution in the economic development of the world. It provides meat to the whole world, which is full of essential elements, playing great roles in health development, the sector also generates employment for the whole world and plays great role in poverty reduction (Naushad *et al.*, 2021). Scanes (2007) opined that the primary product of poultry (meat and eggs) has been rising rapidly, reflecting consumption, based in turn on consumer preference for these high quality products and the relatively low price because of the efficiency of production.

In the year 2015 alone, global production of meat from poultry stood at 100.6 million tonnes and this figure is expected to hit 143.3 million tonnes by the year 2030 (FAO, 2015) as quoted in Abu *et al* (2022) in Musa and Shafi'u (2025). Coupled with the rise in human population with the current security challenges which impairs production of large ruminant animals, calls for urgent need to increase production of farm animals with high but short production cycle such as broiler chickens (Igwe *et al.*, 2022), quoted from Musa and Shafi'u (2025). Noiler is a dual purpose chicken breed raised for both meat and eggs to support food security by improving household income, due to their being profitable (Bamidele *et al.*, 2019 and Suleiman *et al.*, 2019) quoted in (Alabi *et al.*, 2024). It is developed in Nigeria by Amo Farm Sieberer Hatchery, Ibadan. They are easier to raise and manage, an improvement on the indigenous breeds, through the cross breeding of our indigenous cockerels with the exotic White Plymouth to improve the yield and productivity of the indigenous breeds and ensure that chickens can easily be produced by farmers on an extensive system as practiced by most rural farmers (Sowunmi *et al*, 2022) in Musa and Shafi'u (2025).

They are easier to raise and manage, has a high survival rate, less susceptible to diseases, rugged in nature and resistant to harsh weather conditions, can scavenge for food and water like other indigenous breeds. (Animashahun *et al.*, 2022). According to Adeniyi, *et al.* (2005) the scarcity and high costs of conventional feed ingredients are major factors limiting the growth of the poultry industry globally, hence research have now been driven into the use of alternative feed ingredients for poultry feeding (Dilala, 2024). This high price of the conventional poultry feed ingredients in Nigeria have increased the feeding cost to about eighty per cent (80.00 %) of the cost of production ((Durunna *et al.*, 1999) in Obienyem *et al* (2023). Soy bean and groundnut are the main conventional crude protein sources for livestock diet in Nigeria acting also as source of food for man thus creating an unhealthy competition between human and live stocks leading to an increase in its cost. The search for a novel high

quality, cheap, toxic free and readily available source of plant protein is now a major concern of livestock nutritionists in much of the developing world even more than before (Adeniji *et al.*, 2005., Obun, 2008)) in Musa and Shafi'u (2025). One of such legumes with great prospect as alternative and replacement for soybean and groundnut is the cassia plant; an unconventional legume seeds that are still under utilised, with little known about their chemical composition and nutritional values (Assam *et al.*, 2019).

Dilala (2024) reported a proximate composition profile of the raw seeds as dry matter (92.50 %), crude protein (16.25 %), crude fiber (9.03 %), ash (5.21 %), ether extract (4.02 %), nitrogen free extract (33.38 %) and the antinutrient content values of (3.06 %) tannin, (2.12 %) phytate, (1.98 %) oxalate and (1.81 %) saponnin. Oshoke and Akinyemi (2015) however reported proximate values of (95.65 %), (11.92 %), (61.88 %), (3.69 %) and (18.74 %) for the dry matter, crude fiber, nitrogen free extract, ether extract and crude protein respectively. For the antinutrient factors the following values of (0.99, 0.14 and 0.28) mg/100 ml for the phytic acid, tannin and phytate respectively. Muhammad (2022) reported reduction values of the anti nutrient contents of the seeds after toasting by (63.00 %), (89.00 %) and (61.00 %) for the tanins, phytate and oxalate respectively.

Objectives of the Study

The general objective of this research is to:

“Determine the effects of the inclusion of varying levels of processed cassia seeds as replacement for crude protein on the carcass characteristics of noiler chickens.

The specific objectives are as outlined below:

1. To determine the anti - nutrient factor content of the raw, twenty-four (24) hours soaked and twenty (20) minutes toasted cassia seeds, hence to ascertain their effectiveness as replacement for crude protein in the carcass characteristics of noiler chicken chickens.
2. To determine the proximate compositions of the raw, twenty - four (24) hours soaked and twenty (20) minutes toasted cassia seeds.
3. To recommend the best processing method and best level of inclusion of the cassia seeds in noiler starter and finisher feeds on their carcass characteristics at the least possible cost.
4. To equip the youths with an enterprenural mindset towards the search and utilization of available unconventional feed materials within the environment for possible research and incorporation into livestock feeds.

Research Hypotheses

The following hypotheses are assumed.

Null hypothesis:

- 1: There are no significant differences in the anti - nutrient factor content and proximate composition of the raw, twenty - four (24) hours soaked and twenty (20) minutes toasted cassia seeds meant for inclusion in noiler chicken feeds.
2. There are no significant differences on the carcass characteristics of noiler chickens offered varying levels of the twenty (20) minutes toasted cassia seed meal as crude protein replacement.

Alternative Hypotheses:

1. There are significant differences in the anti - nutrient factor content and proximate composition of the raw, twenty-four (24) soaked and twenty (20) minutes toasted cassia seeds meant for inclusion in noiler chicken feeds.
2. There are significant differences on the carcass characteristics of noiler chickens fed varying levels of twenty (20) minutes toasted cassia seeds as crude protein replacement.

Materials and Methods

Location of the Experimental Site

The experiment was carried out at the Demonstration Farm of the Agricultural Education Department, Federal University of Education, Kano, along Madobi Road, under Kumbotso Local Government Area within the municipality. The area lies between latitude 11 55 and longitude 8 36 E at an altitude of 460.00 m above sea level, falling within the sudan geo – ecological zone, with an annual rainfall of 600.00 – 1,000.00 mm, commencing from late May to early October (KNARDA, 2001).

Sources of the Experimental Materials

The cassia seeds and noiler chickens

The cassia seeds were bought from *Kuyan ta Inna* a nearby village, during its period of abundance at the peak of the dry season, while the noiler chickens were purchased from a Kano based distributor for Amo hatchery with main headquarters in Ibadan, Oyo state.

Processing of the Cassia Seeds

They were first separated from the pods with a pen knife mechanically and then sieved. The raw seeds were soaked in an open container at the rate of (75.00 gm/375.00 ml of water) for twenty- four (24) hours at room temperature (Augustine *et al.*, 2020), after which the water contents were discarded, the seeds were dried and milled into granules. Another 200.00 gm of the raw cassia seeds were poured into an open aluminum container, placed over an open

charcoal fire and gradually toasted for twenty (20) minutes (Tsado *et al.*, 2013), it was allowed to cool, milled into granules and kept for use in the experimental procedures. A further 200.00 gm of the raw sample was also milled into granules. All the three samples were taken to the Laboratory for analysis of their anti - nutrient contents and proximate compositions.

Laboratory analysis

The processed and raw cassia seeds and experimental diets were taken to the Feed Nutrition Laboratory of the Animal Science Laboratory at the Faculty of Agriculture, Bayero University, Kano for analysis of their proximate compositions according to AOAC (1995). The individual components analysed were the dry matter, moisture content, crude protein, crude fiber, ether extract and ash while the nitrogen free extract was determined by differences Tables 1, 2 and 6. Analysis of the anti - nutrient factor of the raw unprocessed cassia seeds, twenty - four (24) hours soaked and twenty (20) minutes toasted cassia seeds were carried out at the Biochemistry Laboratory of the Faculty of Basic Medical Sciences, Bayero University, Kano. Table 1.

Table 1: Proximate composition of the broiler starter mash (0 to 4th week)

Parameters (%)	0.00 % Toasted cassia seeds inclusion	5.00 % Toasted cassia seeds inclusion	10.00 % Toasted cassia seeds inclusion	15.00 % Toasted cassia seeds inclusion	20.00% Toasted cassia seeds inclusion	25.00% Toasted cassia seeds inclusion
Dry matter	89.94	90.12	89.78	90.32	88.74	89.91
Moisture content	10.06	9.88	10.22	9.68	11.26	10.09
Crude protein	21.74	24.06	22.97	23.56	24.26	24.51
Crude fibre	6.28	7.56	7.93	8.12	8.43	8.71
Ether extract	3.41	3.88	3.62	3.77	3.91	3.86
Ash	3.42	3.93	4.24	4.46	4.72	4.96
Nitrogen free extract	55.11	50.69	51.02	50.41	47.42	47.87

Source :(Musa and Shafi'u, 2025).

Table 2: Proximate composition of the broiler finisher mash (5th to 8th week)

Parameters (%)	0.00 % Toasted cassia seeds inclusion	5.00 % Toasted cassia seeds inclusion	10.00 % Toasted cassia seeds inclusion	15.00 % Toasted cassia seeds inclusion	20.00% Toasted cassia seeds inclusion	25.00% Toasted cassia seeds inclusion
Dry matter	88.69	91.23	90.36	89.54	90.67	90.55
Moisture content	11.31	8.77	9.61	10.46	9.33	9.45
Crude protein	18.94	19.26	19.32	18.76	18.89	19.94
Crude fibre	8.67	8.93	8.65	8.83	9.69	9.14
Ether extract	3.32	3.51	3.62	3.56	3.74	3.82
Ash	3.61	3.72	3.94	3.89	4.02	3.92
Nitrogen free extract	52.48	54.58	54.48	55.04	55.66	55.18

Source : (Musa and Shafi'u, 2025).

Experimental Diets.

Six (6) broiler starter (0 to 4th week) diets were formulated according to NRC (1994) recommendations with a (20.00 %) crude protein and a metabolisable energy value of 2,800 Kcal/Kg at various inclusion levels of the twenty (20) minutes toasted cassia seeds as follows (0.00 %), (5.00 %), (10.00 %), (15.00 %), (20.00 %) and (25.00 %) representing Treatments one (1) serving as the control, two (2), three (3), four (4), five (5) and six (6) respectively. Table 3.

Table 3: Feed composition at the broiler starter phase (0 to 4th) weeks

Ingredients (%)	0.00 % Toasted cassia seeds inclusion	5.00 % Toasted cassia seeds inclusion	10.00 % Toasted cassia seeds inclusion	15.00 % Toasted cassia seeds inclusion	20.00 % Toasted cassia seeds inclusion	25.00 % Toasted cassia seeds inclusion
Maize	59.61	59.61	59.61	59.61	59.61	59.61
GNC	18.11	15.01	14.23	13.43	12.64	11.86
SBM	8.23	10.01	9.48	8.96	8.43	7.90

Cassia seeds	0.00	1.32	2.64	3.95	5.28	6.60
Wheat offals	10.00	10.00	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.27	0.27	0.27	0.27	0.27	0.27
Lysine	0.73	0.73	0.73	0.73	0.73	0.73
Vit/Min premix	0.25	0.25	0.25	0.25	0.25	0.25
Calculated analysis						
ME (Kcal/Kg)	2,800	2,800	2,800	2,800	2,800	2,800
% Crude Protein	20.00	20.00	20.00	20.00	20.00	20.00
% Calcium	1.47	1.46	1.46	1.45	1.47	1.48
% Phosphorus	0.72	0.72	0.71	0.72	0.72	0.70
% Ether extract	3.77	3.76	3.76	3.77	3.75	3.76
% Crude fiber	7.09	7.09	7.09	7.08	7.07	7.06
% Lysine	0.78	0.78	0.78	0.77	0.79	0.78
% Methionine	0.38	0.36	0.37	0.36	0.37	0.38
Feed cost N/Kg	478.96	489.18	499.57	478.89	561.95	478.67

Source: (Musa and Shafi'u, 2025).

Another six broiler finisher (5th to 8th weeks) diets were formulated according to same NRC (1994) recommendations with an 18.00 % crude protein value and metabolisable energy of 2,700 Kcal/Kg, based on (0.00 %), (5.00 %), (10.00 %), (15.00%), (20.00 %) and (25.00 %) inclusion levels of the toasted cassia seeds, representing Treatments one (1) serving as the control, two (2), three (3), four (4), five (5) and six (6) respectively. Table 4.

Table 4: Feed composition at the broiler finisher phase (5th to 8th) weeks

Ingredients (%)	0.00 % Toasted cassia seeds inclusion	5.00 % Toasted cassia seeds inclusion	10.00 % Toasted cassia seeds inclusion	15.00 % Toasted cassia seeds inclusion	20.00 % Toasted cassia seeds inclusion	25.00 % Toasted cassia seeds inclusion
Maize	53.76	53.76	53.76	53.76	53.76	53.76
GNC	21.25	18.12	17.17	16.21	15.26	14.31
SBM	11.72	11.58	11.44	10.81	10.17	9.53
Cassia seeds	0.00	1.59	3.18	4.77	6.36	7.95
Wheat offals	10.00	10.00	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50

Salt	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.70	0.70	0.70	0.70	0.70	0.70
Vit/Min premix	0.25	0.25	0.25	0.25	0.25	0.25
Calculated analysis						
ME Kcal/Kg	2,700	2,700	2,700	2,700	2,700	2,700
Crude protein (%)	18.00	18.00	18.00	18.00	18.00	18.00
Calcium (%)	1.44	1.43	1.44	1.45	1.44	1.45
Phosphorus (%)	0.72	0.71	0.70	0.72	0.72	0.71
Ether extract (%)	4.21	4.20	4.22	4.21	4.23	4.23
Crude fiber (%)	6.96	6.96	6.95	6.94	6.93	6.92
Lysine (%)	0.80	0.79	0.79	0.81	0.78	0.79
Methionine (%)	0.41	0.40	0.41	0.41	0.42	0.42
Feed cost N/Kg	678.47	704.24	775.93	692.44	740.84	750.36

Source: (Musa and Shafi'u, 2025).

Design and Management of the Experimental Chickens.

Five hundred (500) day old mixed sex noiler chickens were placed under the six (6) dietary treatments highlighted above with three (3) replicates of twenty seven (27) chickens each in a completely randomized design (CRD) and reared in a deep litter system divided into eighteen (18) pens each, measuring 2.20m X 2.00m and a height of 1.70m with feed and water provided *ad libitum* and a constant provision of heat and light using charcoal and torchlights as sources respectively, throughout the brooding period of (0 to 4th) week. This arrangement was maintained at the fifth (5th) to the eighth (8th) week of the study.

Vaccination Schedule of the experimental chicks

Glucose and multivitamins were provided on the first (1st) and second (2nd) day of stocking, followed by first anticoccidiosis vaccine plus multivitamin on the seventh (7th) day, then gumboro vaccine and multivitamin on the eight (8th) day. Second anticoccidiosis vaccine was administered on the fourteenth (14th) day, then lasota vaccine on the sixteenth day, second gumboro vaccine on the twenty first (21st) day, third anticoccidiosis vaccine on the twenty eighth (28th) day, followed by second lasota vaccine on the thirty fifth (35th) day and finally deworming on the forty second (42nd) day.

Data Collection.

Carcass Characteristics

At the end of the eighth (8th) week of the study, three (3) birds were randomly selected from each replicate, fasted overnight, their live weights taken, after which they were severed by the jugular vein using a very sharp knife. The carcasses were then immersed in warm water at a temperature of 75.00 °C for ten (10) minutes, de feather. The live body weights, carcass weights were measured using a sensitive measuring scale to the nearest (0.01g). The dressing percent was calculated and expressed as carcass weight/live weight X 100. The organ weights were calculated and expressed as percent live weight, while the cut parts were calculated as percent carcass weight.

Statistical Analysis

All the data generated from the studies were analysed by the one - way analysis of variance (ANOVA) system using the general linear model of the 2019 edition of the Statistical Analytical System (SAS) and the differences between the means were separated using the Tukey studentised Test.

Results and Discussions

Anti - nutrient factor contents of the raw and processed cassia seed

Results of the anti - nutrient factor contents of the raw and processed cassia seeds are shown in Table 5. The results indicate a significant ($P < 0.05$) reduction from the raw unprocessed sample in all the four anti - nutrient factor contents analysed, with the processed method by twenty (20) minutes toasting having the highest reductions values of 18.85mg/100g (25.55 %), 173.03mg/100g (10.62 %) and 87.90 mg/100g (4.97 %) for the phytate, tannin and saponins respectively, compared to that processed by twenty - four (24) hours soaking.

Table 5 : Antinutrient factor contents of the raw and processed cassia seeds.

Parameters (Mg/100ml)	Raw	24 Hrs soaked	20 mts Toasted	SEM
Phytate	25.25 ^c	21.31 ^b	18.95 ^a	0.03
% Reduction (Phytate)	0.00	16.26 ^b	25.55 ^a	0.32
Oxalate	9.78 ^c	7.79 ^a	8.82 ^b	0.08
% Reduction (Oxalate)	0.00	20.43 ^a	9.65 ^b	4.41
Tannin	193.56 ^c	178.92 ^b	173.03 ^a	0.79
% Reduction (Tannin)	0.00	7.56 ^b	10.62 ^a	0.16
Saponin	92.51 ^c	90.74 ^b	87.90 ^a	0.22
% Reduction (Saponin)	0.00	2.31 ^b	4.97 ^a	0.51

SEM = Standard error of the mean.

a, b,c = Means with different superscripts across the raw are significantly ($P < 0.05$) different.

Source: (Musa and Shafi'u, 2025).

The results indicate significant differences ($P < 0.05$) observed in all the parameters assessed, with the twenty (20.00) minutes toasted processing method having the least per cent concentration of phytate (18.95 mg/100ml), tannin (173.03 mg/100ml) and saponin (87.80 mg/100ml). Dilala (2024) however recorded significant ($P < 0.05$) differences in his results with the tannin having value of (0.91 mg/100ml), phytate (0.41 mg/100ml), oxalate (0.42 mg/100ml) and saponin (0.60 mg/100ml) after toasting the seeds for thirty (30.00) minutes, this could be attributed to the higher period of time taken by the author of thirty (30.00) minutes of toasting, as compared to the twenty (20.00) minutes taken in this study.

As of the per cent reduction, Haritha and Uma Mashewa (2007) recorded (59.53 %) and (78.43 %) for the oxalate and tannin respectively for the twenty four (24.00) hour soaked processing method and values of (23.02 %) and (90.29 %) for the oxalate and tannin respectively for the processing method by roasting. This study however, recorded percent reduction values of (20.43 %) and (7.56 %) for the oxalate and tannins respectively by soaking for twenty four (24.00) hours and values of (9.65 %) and (10.62 %) for the oxalate and tannins respectively after toasting the seeds for twenty (20.00) minutes, which might be attributed to the varietal differences of the processed seeds and probably the analytical methods used by the various authors which were not reported.

Proximate composition of the raw and processed cassia seeds.

Table 6: proximate composition of the raw and processed cassia seeds

Parameters (%)	Raw	24 Hrs soaked	20 mts Toasted	SEM
Dry matter	91.47 ^b	91.05 ^c	91.66 ^a	0.02
Moisture content	8.53 ^b	8.95 ^a	8.34 ^c	0.02
Crude protein	9.46 ^b	9.41 ^c	11.26 ^a	0.001
Crude fiber	5.66 ^b	5.65 ^c	7.11 ^a	0.001
Ash	1.74 ^c	1.87 ^b	1.97 ^a	0.0002
Ether extract	4.06 ^b	3.99 ^c	4.35 ^a	0.0003
Nitrogen free extract	70.74 ^a	70.56 ^b	66.36 ^c	0.014

SEM = Standard error of the mean, a, b, c = Means with different superscript across the treatment are significantly ($P < 0.05$) different. Source (Musa and Shafi'u, 2025).

Results indicate significant ($P < 0.05$) differences in all the parameters analysed. The crude protein content value of (11.26 %) recorded for the processed method by toasting for twenty (20) minutes was significantly ($P < 0.05$) higher than the (9.41 %) recorded for the twenty - four (24) hours processing method by soaking. The twenty (20) minutes processing method by toasting also recorded a significantly ($P < 0.05$) higher values for the crude fiber

(7.11 %), ash (1.97 %) and the ether extract contents (4.35 %) as against the twenty - four (24) hour soaking method with (5.65 %) crude fiber content, (1.87 %) ash content and (3.99 %) value for the ether extract.

The crude protein value recorded by Dilala (2024) in the raw samples indicates a value of (16.25%), Oshoke and Akinyemi (2015) recorded (18.74 %), while Assam *et al* (2017) recorded a value of (9.63 %). Values for the thirty (30.00) minutes processed method by Haritha and Uma mashewari (2007) gave a (16.25 %) value for the crude protein, which was higher than the (9.41 %) and (11.26 %) obtained from this study through the processing method by soaking for twenty four (24.00) hours and toasting for a thirty (30.00) minutes period.

Effects of varying inclusion levels of toasted cassia seeds on the carcass characteristics of noiler chickens at the 8th week.

Results of the effects of varying levels of toasted cassia seed meals on the carcass characteristics of noiler chickens are shown in Table 7.

Table 7 : Effects of toasted cassia seed meals on the carcass characteristics of noiler chickens at the 8th week.

Parameters	0.00 %	5.00 %	10.00 %	15.00 %	20.00 %	25.00 %	SEM
Live body weight (g)	544.23d	522.19c	554.21b	559.62 ^a	562.70 ^a	562.07 ^a	3.59
Carcass weight (g)	365.83f	372.69e	394.50d	383.14c	312.28b	325.46a	3.89
Dressing per cent	67.22d	71.37 ^a	71.18b	68.47c	55.50f	57.91e	0.68
Cut p^arts as percent carcass weight							
Head (%)	5.74e	6.58c	4.80f	6.45d	10.89 ^a	10.56b	0.04
Neck (%)	3.69b	4.96 ^a	3.58c	3.41d	3.25e	3.23ef	0.04
Thigh (%)	5.65 ^a	5.64 ^a	5.56b	5.16c	4.42d	4.89c	0.07
Wing (%)	3.52b	3.63 ^a	2.93e	3.20c	2.89ef	3.11d	0.04
Back (%)	4.37b	4.63 ^a	4.18c	3.53de	3.55d	3.53de	0.11
Leg (%)	1.89b	2.19 ^a	1.71e	1.75d	1.65f	1.85c	0.006
Drumstick (%)	9.93c	10.85 ^a	8.65de	8.70d	7.49f	9.59b	0.26
Organ parts as percent live							

		weight					
Heart (%)	0.91d	1.07 ^a	1.01b	0.89e	0.86f	0.96c	0.002
Liver (%)	1.62e	1.85 ^a	1.76b	1.67d	1.71c	1.15f	0.009
Gizzard full (%)	2.74c	3.31 ^a	2.68de	2.86b	2.24f	2.69d	0.04
Gizzard empty (%)	2.18c	2.29 ^a	2.26b	1.97d	1.91e	1.82f	0.02
Intestine weight full (%)	3.73b	3.91 ^a	3.66c	3.44f	2.64e	3.09d	0.09
Lungs (%)	0.81e	0.89c	0.88d	0.91b	0.88d	0.92 ^a	0.001

SEM = Standard error of mean, a, b, c, d = means with different superscripts across the treatments are significantly (P < 0.05) different.

The results indicate significant (p < 0.05) differences observed in all the parameters measured both for the cut parts and organ weights. The 5.00 % inclusion levels showed the highest values for the neck (4.96 %), thigh (5.64 %), wing (3.63 %), back (4.63 %), leg (2.19 %), drumstick (10.85 %), likewise for the organ weights with the heart recording (1.07 %), liver (1.85 %), gizzard full (3.31 %), gizzard empty (2.29 %) and intestine weight full intestine weight full (3.91 %). The least values were recording at the 20.00 % and 25.00 % inclusion levels, mainly for the wings (2.89 %), back (3.55 %), leg (1.65 %), drumstick (7.49 %), heart (0.86 %) and gizzard full (2.24 %).

Antyev *et al* (2017) found no significant (P > 0.05) differences in values of the carcass characteristics and internal organ weights across the treatments, variation only occurred in values obtained for the gizzard with the inclusion of various levels of one hour, thirty minutes boiled *Senna occidentalis* seed meal. Okoroafor and Dadean (2024) also observed that all the carcass characteristics measured were not significantly (P > 0.05) different up to 20.00 % inclusion of the thirty (30) minutes boiled cassia seed meal, except for the wings, thigh weight and back cuts. Significant (P < 0.05) differences were however observed in the heart, liver, lungs and the empty gizzard values. Indicating that the carcass characteristics of chickens do tolerate the inclusion levels of cassia seed meals processed by boiling up to 20.00 % better than the results obtained from this study.

Peace and Assam (2024) also recorded no significant (P > 0.05) differences across the treatments except for the wings, which had values ranging from 10.32 Kg for Treatment 1 to 8.93 Kg for T2, using varying inclusion levels of thirty (30) minutes boiled *Cassia tora* seeds.

Contributions to Knowledge:

- (1) Removal of the anti – nutrient factor content of cassia seeds by toasting for twenty (20) minutes shows a higher significant (P < 0.05) reduction in all the parameters analysed

- compared to the twenty – four (24) hour soaking method and higher crude protein value of (11.26 %) as compared to the (9.41 %) obtained from the soaking method.
- (2) Removal of the antinutritional content by toasting for twenty (20) minutes, reveals a higher crude protein content (11.26 %) than the twenty hour (24) hour soaking method (9.41 %).
- (3) Dietary inclusion of toasted cassia seeds up to 25.00 % as replacement for crude protein in noiler feeds at 0 to 4 weeks and 5 – 8 weeks showed significant ($P < 0.05$) differences in all the parameters of the carcass characteristics analysed.

References

- Abu, M.H., Okolo, G.P & Eboh, S. (2022). Nutritional and industrial application of broiler chicken feathers, a review. *Nigerian. J. Anim. Sci.* 2022. 24 (2): 163 – 174.
- Adeniyi, C.A., Fakoye, K.A & Omomohwo, V.R. (2005). Utilization of *Amarantus spp* in the diet of Tilapia *Oreochromis niloticus*. *Trop. J. Animal Science* 9:79 – 83.
- Alabi, F.H., Iyanda, D.J., Abgoola, E.E., Oye, T.M., Olagunju, A., Olayinka, D.O., Muhammad, J.O & Olaniyi, W.A. (2024). Comparative growth performance among noiler chickens of different plumage patterns at starter phase. *Proc. 49th Conf. Nig. Soc. For Anim. Prod.* 24 – 27 March, 2024; Univ. of Ibadan, Nigeria pp 105 – 107.
- Animashahun, R.A., Alabi, O.O., Okeniyi, F.A., Olawoye, S.O., Shoyombo, J.A & Falana, B.M (2022). Performance and blood profile of noiler chickens fed diets containing graded lavals of Parkai biglobosa leaf meal. *Food Research* 6(5):256 – 265 (October 2022).
- Antyev, M., Nyameh, J., Shaahu, D.T., Highest, E. C & Uduak, W. (2017). Performance, Carcass characteristics, Growth, Haematology and Serum biochemistry of Broiler chickens fed Processed senna occidentalis Seed meal. *CARD International Journal of Applied Medical Science and Applied Biosciences (IJMSAB) ISSN: 2536 – 7331 (print): 2536 – 734x (online) Volume 2, Number 3, September, 2017. Pages 30 – 40.*
- AOAC (1995). Official Method of Analysis (17th edition) Association of Official Analytical Chemist, Washington D.C. U. S.A.
- Assam, E., Ndelekwute, E & Okonkwo, A. (2017). Nutritional evaluation of sickle pod (Cassia tora) seed meal in broiler diet. *International Journal of Agriculture, Environment and Bioresearch* Vol.2, No 03; 2017.
- Assam, E., Ndelekute, E.K., Demo, K & Nwachukwu, S.N. (2019). Effect of boiling on the proximate composition, mineral and antinutritional factor of Cassia tora seeds for poultry feed production. *NSAP, 44TH Annual Conference- ABUJA, 2019.* 59 -62.

- Augustine, C, Igwebuike, I.U., Salome, S &Midau, A. (2020). Evaluation of economic performance of broiler chickens fed graded levels of processed *Cassia obistufolia* seed meal. *www. Research gate. Net*.
- Dilala, M. A. (2024). Evaluation of proximate analysis, amino acid profile and the level of anti nutrient factor of raw and differently processed *Senna obtusifolia* seeds. *IOSr Journal of Agriculture and Veterinary Science (IOSr. Javs) E – Issn:2319 – 2380, P – ISSN: 2319 – 2372. Volume 17, ISSUE 12 Ser. 1. (December, 2024), pp 09 – 15.*
- Haritha, P & Uma & Mashewari, K. (2007). Effect of processing on the antinutrient factor and antimicrobial activity of Sickie *Senna* Seeds (*Cassia tora. L*). *Legume Res. 30 (2) : 108 – 112, 2007.*
- FAO (2015). Food and Agricultural Organisation of the United Nation.
- Igwe, R.O., Osakwe, I. I., Ogunnupebi, J. T., Okeh, E.N & Etim, N. N. (2022). Effects of selenium on growth performance, haematological index, carcass characteristics and sensory properties of broiler chickens. *Nig. J. Anim. Prod. 2022. 49 (3).*, 140 – 147 <https://doi.org/10.51791/njap.v49i3.3345> @ Nigerian Society for Animal Production.
- KNARDA (2001). Kano Agricultural and Rural Development Authority, Metereological Station reports. Temperature record book and management Unit. 11:1 – 3.
- Muhammad, A. (2022). Sule Lamido University Journal of Science and Technology (SLUSJT) 2022, Volume 3 issue 1 and 2.
- Musa, H.A &Shafi’u, S. (2025). Effects of varying levels of toasted cassia seeds (*Cassia obtisfula L.*) as crude protein replacement on the growth performance of noiler chickens. *Kano Journal of Geography Education and Sustainable Development. Yusuf Maitama Sule, Federal University of Education, Kano, 2 (1), 46 – 59.*
- Naushad, K., Mahnoor, N., Shah, F & Shah, F. (2021). Poultry farming industry contribution in the world economy. September, 2021. *Doi:10.13140/RG.2.2.22054.8681.*
- NRC (1994). Nutrient requirements of domestic animals in animal nutrition requirement, poultry 9TH edition. National Academy Press, Washington, D.C., U.S.A. Page 15.
- Obienyem, J.N., Ezebo, R.O., Ozoh, C.N & Omumuabuike, J.N. (2023). A comparative study of the performance of noiler and broiler birds in tropical humid zone (South eastern Nigeria). *Intl, Digital Org for Scientific Res. IDOSR JOURNAL OF APPLIED SCIENCES 8(30 147 – 150. 2023. 147 – 150.*
- Obun, C.O & Ayanwale, B.A. (2008). Performance, nutrient digestibility and cost evaluation of acid and roasted *Atzecia Africana* seed meal fed finishing broiler chicks. *Nig. J. anim. Prod. 35:9 – 17.*

- Okoroafor, P. I & Dadean, A.S. (2024). Influence of Boiled Cassia Seed Meal on Carcass and Internal Organs Characteristics of Starter Broiler Chickens. *International Journal of Life Science and Agriculture Research* 03(03).
- Oshoke, J.O & Akinyemi, A.O. (2015). Nutritional value of Cassia occidentalis and it's potential contribution to aquaculture feed. *Pakistan Journal of Nutrition*. Year 2015/Volume: 14/issue 12/page No. 924 – 930.
- Peace, I.O & Assam, E. D. (2024). Influence of boiled Cassia tora Seed Meal on Carcass and Internal organ characteristics of starter broiler chickens. *International Journal of Life Sciences and Agricultural Research*. Vol. 3 NO. 3(2024): Volume 03 issue 03, March 2024.
- Scanes, C. G. (Ed) (2007). The global importance of poultry. *Poultry Science* 86 (6)1057 – 8.
- Sowunmi, F.A., Adeleye, O.S., Salman, K.K & Okewumi, F.T. (2022). Determinants of poultry farmer's willingness to raise Noiler birds in Oluyole Local Government Area of Oyo State. *World Journal of Science, Technology, and sustainable Development (WJSTSD)*. Vol.19, No 1. 2022. Pp 25 –
- Tsado, D., Ayanwale, B.A & Aremu, B.A. (2013). Effect of feeding processed cassia tora seeds based diets on the growth performance and biochemical indices of weaner rabbits. *Nigerian J. Anim. Sci.* 2013, vol 15: 49 – 58.
- SAS (2019). Statistical analytical system.

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