NUTRITIONAL EVALUATION OF SICKLE POD (CASSIA TORA) SEED MEAL IN BROILER DIE

Esther Assam, *Eugenes Ndelekwute and Anthony Okonkwo

Department of Animal Science, University of Uyo, Uyo, Nigeria

ABSTRACT

Raw Cassia toraseed meal was assessed to determine its nutritional value using 200 Marshal broilers. Five dietswere formulated so that diet1 (control)contained no C. tora.Diets2 – 5 contained 2.5, 5.0, 7.5 and 10.0% respectively at starter and finisher phases. Each treatment was replicated four times containing 10 birds in completely randomized design (CRD). Starter diet was fed from week 1 – week 4 while finisher diet was given from week 5 – week 8ad libitum. The seed meal contained low crude protein and high nitrogen extract. It contained tannins, saponins, phytate and hydrogen cyanide. At the starter phase and overall, 7.5 and 10.0% levels reduced live weight, feed intake, and produced poor feed: gain ratio. There were no significant differences between the control, 2.5 and 5.0% in all the parameters mentioned. In conclusion of 5.0% raw C. tora seed meal could in broiler diets is advocated.

Keywords: broilers,Cassia tora, nutritional value, seed meal.

Introduction

The demand for livestock products is rapidly increasing in most developing countries. As a result, there is inadequate consumption of animal protein by an average Nigerian. Poultry production has been identified as one of the quickest means of correcting this inadequacy in animal protein intake among Nigerians (Ukachukwu 2000). This is because poultry has short generation interval and general acceptability without any religious taboo Ukachukwu et al. (1999).

Feeding constitutes an important part of poultry production. Ukachukwu (2015) observed that developing countries have feed deficits. He reported that feed is the highest single cost input in production of poultry. In poultry feed cost is put at about 70-80% of total cost of production, while in other livestock it is about 45 – 64% (Ologhobo et al., 1993;Ukachukwu, 2015). This, according to Ukachukwu (2015) is made complex and complicated by competition among human, the industry and farm animals for the same food items as either food for man, feed for animals and raw materials for the industry.

Since feed is a major factor in poultry production, reducing feed cost is a priority for every poultry farmer and animal nutritionist. Currently, feed ingredients for poultry, especially those for which there is competition with humans, are scarce and expensive (Ologhobo et al. 1993).

Among the feed ingredients, protein and energy sources are most expensive. For instance, soya bean meal, the most widely used plant protein source and maize, the most widely used energy source, are very expensive in Nigeria, due to the fact that demand for them out weighs their supply.

One of the ways of getting round this problem of high feed cost is by looking for alternative feedstuffs, which have little or no dietary value for man and industry. However, some unconventional legume seeds and cereal grains are still under-utilized, which little are known about their chemical composition and nutritional values. The seeds of sickle pod (Cassia tora) are one of such seeds, which have good potential as alternative, cost effective source of protein in monogastric diet, especially broilers. Smith (2001) observed that Cassia tora seeds could serve as a protein rich feed for livestock and birds, having contained crude protein up to 23%. However, there is paucity of information on the utilization of Cassia tora seed meal in broiler diet. Therefore the objectives of this study were to determine the nutrients and anti-nutrients in raw Cassia tora seeds and effect of processing on these components; metabolizable energy; the optimal dietary level of raw Cassia tora seed meal and its effects on growth performance of broiler chickens.

2MATERIALS AND METHODS

2.1Site of Experiment

The research was conducted at the Poultry Unit of Department of Animal Science, Departments of Animal Science and Biochemistry laboratories, University of Uyo, Uyo, Akwa Ibom State. Uyo is located on latitude 40 591 and 50 041N and longitude 70 531 and 80 001E, with an elevation of about 60.96m above sea level. Uyo has a bi-modal rainfall pattern with mean annual rainfall of 2190mm and mean relative humidity of 81% (University of Uyo Meteorological Station Report, 2016).

2.2Processing of Cassia,Biochemical Analysis and Determination of Metabolizable Energy

Mature dried pods of Cassia torawere obtained from Yelwan Tudu, Bauchi State, Nigeria and the pods were opened to release the seeds. The seeds were boiled according to the procedures of (Ukachukwu and Obioha, 1997). The raw seeds were boiled for 90 minutes. Water was brought to boil and raw seeds added and allowed for 90 minutes. At the end of the boiling, the water was drained off. Thereafter, the boiled seeds were dried under the sun. The proximate composition and anti-nutritional factors analyses were carried out according to AOAC. (2000). The procedures described by Silbbab (1969) and cited by Ukachukwu(1999) were applied for the determination of metabolizable energy of the seeds of the Casia tora.

2.3Experimental Design

A total of 200 Marshal day old broiler chicks were used. There were allotted to five treatment groups. Each treatment was replicated four times with 10 birds per replicate, in a Completely Randomized Design (CRD). Five diets were formulated which were the treatment groups. The Cassia tora was included in the diets (Tables 1 and 2) in a way that:

Treatment 1 was diet containing no raw Casia tora.

Treatment 2, was a diet containing 2.50% raw Cassia tora.

Treatment 3, was a diet which contained 5.0%

Treatment 4 diet contained 7.5% and

Treatment 5 diet had 10% Casia tora.

The birds were managed under deep litter system with wood shavings as the bedding materials. At day old glucose D was added to their drinking water, and vitamin and antibacterial drug were given from the second day for seven days. Newcastle disease vaccine was administered to the birds at day old intraocular. Gumboro disease vaccine was give twice (12th and 19th) day during the starter phase and Newcastle disease vaccine (lasota) was given 17th day. Antibacterial and anti-coccidial drugs, and vitamins were given at intervals as prophylactic measures. Feed and water were given ad libitum and the experiment lasted for 56 days (28 days each for starter and finisher phases).

2.4Statistical Analysis

All data collected were subjected to one way analysis of variance (ANOVA) and means that were significantly different were separated by New Duncan Multiple Range Test (NDMRT) according to Steel and Torrie (1980).

3.RESULTS

3.1 Proximate Composition, Minerals, Anti-nutritional Factors, and Energy of Cassia tora

Table 3 shows proximate, mineral and anti-nutritional factors composition of raw Cassia tora.The protein and ether extract content were low while nitrogen free extract was high. Though the nitrogen free extract was high, it did not reflect on the gross energy which was 3594 kcal/kg. The levels of calcium, phosphorus, magnesium, sodium and potassium were low.

All the minerals determined were less than 1%. It contained tannins, phytate, saponnins and hydrogen cyanide.

The gross energy and true metabolizable energy of cassia tora are shown in Table 4. Processing did not improve gross energy but the true metabolizable energy was improved by boiling, toasting, and soaked and boiled compared to the raw. The true metabolizable energies were similar among the processedCassia tora seed meal.The efficiency of gross energy utilization was 68.42 for raw Cassia tora and ranged between 89.10 to 91.17%.

3.2 Growth Performance

Raw Cassia tora significantly (P<0.05) affected all the parameters measured at the starter phase (Table 5).Above 5.0% Cassia tora reduce final live weight as the level was increased with 10% posting the lowest final live weight. The daily weight gain followed similar trend as the final live weight. Daily feed intake was similar in 7.5 and 10%, but significantly reduced compared to the control, 2.5 and 5.0% levels which were also similar. Feed: gain ratio and protein efficiency ratio were negatively affected by including 7.5 and 10% Cassia tora. The values of feed: gain ratio and protein efficiency ratio of the control, 2.5 and 5.0% were the same.

The effect of different levels of raw Cassia toraon final live weight of finisher broiler chicks, feed intake and feed utilization is shown in Table 6. The result showed that Cassia tora negatively affected these parameters at certain levels of inclusion. There was no significant (P>0.05) difference between the control, 2.5 and 5.0% inclusion of Cassia tora in final live weight, daily weight gain, feed: gain ratio and protein efficiency ratio. These parameters were similar in groups that consumed diet that contained 7.5 and 10% Cassia tora. The daily feed intake was significantly (P<0.05) reduced above 2.50% of inclusion. However, inclusion of 2.5% Cassia tora led to similar daily feed intake with the control. Daily gain was reduced by 7.5 and 10% inclusion level.The feed: gain ratio and protein efficiency ratio were higher and lower (P>0.05) in 7.5 and 10% compared to the control, 2.5 and 5.0% respectively.

4 DISCUSSION

4.1 Proximate Composition, Minerals, Anti-nutritional Factors, and Energy of Cassia tora

The result of the proximate composition showed both similarities and variations with the results of earlier reports. For instance, Ingwenye et al. (2010) reported that the dry matter value of the seeds was 92.50%, crude protein 29.54%, ether extract 2.31%, crude fibre 10.18%, ash 3.7% and nitrogen free extract 46.77% while the calorific value was reported to be 325.28Kcal/100g.Earlier[11] reported that crude protein of the raw seeds ranged from 18.56 –

22.93%, crude lipid 5.35 – 7.40%, crude fibre 6.83 – 9.45%, ash content 5.14 – 5.83% and carbohydrate 57 – 60.69% respectively.

The present result therefore indicated that there were variations in ash, nitrogen free extract and protein content and similarities in ether extracts and crude fibre composition when compared with the result of Vadivel and Janardhanan (2002). The present result also showed higher energy content than that reported by Vadivel and Janardhanan (2002) and Ingwenye et al. (2010).Though the nitrogen free extract (starch) content was high the low level of ether extract and high level of fibre could have contributed to the low level of the gross energy compared to some grains such as maize and sorghum.

Though the result of mineral was in variance with the result of Ingweye et al. (2010), it is an indication that Cassia tora seed meal could be a source of calcium, sodium, magnesium, potassium and phosphorus. Ingweye et al. (2010) reported calcium, sodium, magnesium, potassium and phosphorus in raw Cassia tora seed meal to be 0.96, 0.60, 0.64, 1.20 and 0.81% respectively. The calcium content observed in this study (0.58%) was similar with 0.56% reported by Vadivel and Janardhanan (2002), while the values reported by Adamu et al. (2013)for all the minerals tested in this study were lower.

Presence of tannins, saponins, phytate and hydrogen cyanide in the raw C. tora tested is in conformity with the reports that seeds of C. tora contained some anti-nutrients (Ednilson et al., 1998). Also Ingweye et al. (2010) reported that C. tora seeds contain high level of some anti-nutritional factors such as saponin, tannin, oxalate, phytate and alkaloid, which might limit its utilization as livestock feed and human food, if not properly processed. The compositions of these anti-nutrients in raw C. tora seeds according to Ingweye et al. (2010) are: saponin 185, tannins 388.50, oxalate 83.25, phytate 240.50 and alkaloid 260mg/100g dry matter respectively.

The gross energy of both the raw and processed C. tora was the same probably carbohydrate, ether extract and protein were not significantly lost during boiling, toasting and soaking to have led to decrease in gross energy. However, the difference between the true metabolizable (TME) of the raw and processed is an indication that the various processing methods applied improved energy utilization. True metabolizable energy indicates the amount of energy of energy available to the animal that is truly utilized by the animal. The no difference in TMEamong the processing methods goes a long to confirm the importance of processing of non-conventional feedstuffs. Processing such as application of heat reduces anti-nutritional factors in feedstuffs which interfere with nutrient utilization by animals Adamu et al. (2013).

4.2 Growth Performance

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The growth of broiler chickens among other factors depends on the quality of the feed consumed and how it is utilized by the birds. The quality of feed on the other hand depends on the quality of the feedstuffs used to produce it. The major parameters used to evaluate the quality of feedstuffs is their nutrients content and the anti-nutritional factors Afolabi et al. (2017). The trend of effect of the diets on final live weight, feed intake, feed: gain ratio and protein efficiency ratio at the starter phase is an indication that C. tora imparted negatively on the birds at certain levels. The no significant difference observed between the control, 2.5 and 5.0% and poor result recorded at 7.5 and 10% raw C. toraseed meal shows that it contained something that was detrimental to the wellbeing of the birds. This could be attributed to the presence of anti-nutritional factors in raw C. tora seed meal as observed from the result of the biochemical analysis. Anti-nutritional factors have shown to impart negatively on performance of chickens Ukachukwu (2015). According to Herbert and Flory (2002 the poor performance could be attributed to reduced feed intake and poor utilization of feed. This was clearly the case of the result of this study where feed intake was reduced and feed: gain ratio was poorer at 7.5 and 10% levels. For instance, tannins and phytate have been known to undermine respectively the utilization of protein and phosphorus by chickens Ukachukwu (2000). According to Ukachukwu (2002) they bind protein and phosphorus respectively. This could have led to the poor protein efficiency ratio recorded at 7.5 and 10.0% levels.

When the effect of raw C. tora seed meal from week 1 - week 8was considered the results showed similar trend as the result from week 1 - week 4, except the result of feed intake which was reduced by 5.0% C. tora at the end of eight week indicating that the broiler chickens could not tolerate intake of raw C. Tora for a long period at 5% level. This is in agreement with Herbert and Flory (2002) who reported lower final live weight and weight gain of chickens fed up to 10% Cassia seed meal. In another experiment by Augustine et al. (2010) to evaluate performance of broiler chickens fed graded levels of Cassia seed meal, where the seed meal was included at 0%, 2.5%, 5% and 7.5% respectively, and 7.5% at the starter phase recorded lowest live weight. The report also indicated that the result of the live weight attained at finisher phase followed similar trend as the starter phase. This according to the authors was due to increasing concentration of anti-nutritional factors such as saponins and alkaloids in Cassia seed meal as the level was increased. However, Augustine et al. (2010) reported that control diet (diet without cassia seed meal) performed better than diets containing 2.5 and 5.0% cassia seed meal which contradicted the present result where there was no significant different between the control, 2.5 and 5.0%. According to them these suspected anti-nutritional factors may inhibit the utilization of certain essential nutrients and also depress feed intake of the birds, consequently affecting growth.

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Furthermore, Augustine et al. (2010) reported that the result of the live weight gain at starter phase showed similar pattern to that of the finisher phase and compared favorably with 0% inclusion, while 7.5% inclusion of the seed meal recorded the lowest gain. Nevertheless, the authors reported that weight gain at the finisher phase of growth indicated that 0% inclusion had the highest weight gain followed by 2.5% inclusion which is contrary to this report. Another report that was not in line with this report was that of Damron and Jacob (2002)who reported that 3% inclusion level of Cassiaseed meal depressed feed intake of broiler chickens which consequently affected growth, whereas up to 5% inclusion did not lead to poor feed intake and growth in the present result. These differences occurred probably because of different quantities of anti-nutritional factors and other biochemical components in Cassia seeds as reported by deferent authors (Damron and Jacob, 2002; Vadivel and Janardhanan, 2002;Augustine et al., 2010; Adamu et al., 2013). In all, the poor result posted by 7.5 and 10.0% could also be ascribed to the low level of energy of the diets (Tables 1 and 2).

5 CONCLUSION

Raw Cassia tora used in this study showed that though it contained anti-nutritional factors and low crude protein, it could be a valuable non-conventional feedstuff which can be incorporated in broiler feeds even in starter diet at 5.0% level. This is an indication that the level could be higher if it is fed only during finisher phase. It is concluded that 5.0% C. tora should be added to both starter and finisher broiler diets.

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Table 1: Ingredients and nutrients composition of starter diets

	Levels of inclusion of raw *Cassia tora* seed meal				
Parameters (%)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	T5 (10%)
Maize	48.18	46.71	44.26	41.81	39.34
Cassia tora seed meal	-	2.5	5.0	7.5	10.0
Soybean meal	33.81	33.79	33.74	33.69	33.66
Fish meal	3.00	3.00	3.00	3.00	3.00
Palm kernel cake	10.0	10.0	10.0	10.0	10.0
Bone meal	3.0	3.0	3.0	3.0	3.0
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
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
Determined composition (%)					
Crude protein	23.0	23.0	23.0	23.0	23.0
Energy (KcalME/kg)	2850	2832	2813	2795	2776
Ether extract	3.92	3.94	3.96	3.98	4.00
Crude fibre	5.01	4.98	4.95	4.92	4.89
Calcium	1.20	1.20	1.20	1.10	1.10

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Phosphorous	1.01	1.01	1.01	1.00	1.00
Lysine	1.12	1.12	1.12	1.12	1.12
Methionine	0.45	0.45	0.41	0.41	0.40

*premix supplied per kg diet: vitamin A 15,000 I.U, vitamin D_3 13000 iu, thiamin 2mg, Riboflavin 6mg, pyridoxine 4mg, Niancin 40mg, cobalamine 0.05g, Biotin 0.08mg, chooline chloride 0.05g, Manganese 0.096g, Zinc 0.06g, Iron 0.024g, Copper 0.006g, Iodine 0.014g, Selenium 0.24mg, Cobalt 0.024mg and Antioxidant 0.125g. BP = Black pepper. NFE = Nitrogen free extract.

Table 2: Ingredients and nutrients composition of starter diets

	Levels of inclusion of raw *Cassia tora* seed meal				
Parameters (%)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	T5 (10%)
Maize	53.07	51.04	48.56	46.12	43.65
Cassia tora seed meal	-	2.5	5.0	7.5	10.0
Soybean meal	25.93	25.46	25.41	25.39	25.35
Fish meal	2.00	2.00	2.00	2.00	3.00
Palm kernel cake	15.0	15.0	15.0	15.0	15.0
Bone meal	3.0	3.0	3.0	3.0	3.0
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25

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Premix*	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Determined composition (%)					
Crude protein	20.0	20.0	20.0	20.0	20.0
Energy (KcalME/kg)	2850	2832	2813	2795	2776
Ether extract	3.92	3.94	3.96	3.98	4.00
Crude fibre	5.01	4.98	4.95	4.92	4.89
Calcium	1.0	1.0	1.0	1.0	1.0
Phosphorous	0.85	0.85	0.85	0.80	0.80
Lysine (calculated)	1.0	1.0	1.0	1.0	1.0
Methionine (calculated)	0.35	0.35	0.35	0.35	0.35

*premix supplied per kg diet: vitamin A 15,000 I.U, vitamin D_3 13000 iu, thiamine 2mg, Riboflavin 6mg, pyridoxine 4mg, Niacin 40mg, cobalamine 0.05g, Biotin 0.08mg, choline chloride 0.05g, Manganese 0.096g, Zinc 0.06g, Iron 0.024g, Copper 0.006g, Iodine 0.014g, Selenium 0.24mg, Cobalt 0.024mg and Antioxidant 0.125g. BP = Black pepper. NFE = Nitrogen free extract.

Table 3: Proximate Composition, Mineral Content and Anti-Nutritional Factors of Raw Seeds of *Cassia Tora* (% of DM)

Proximate Composition	**(%)**	
Dry matter Crude protein	88.50 9.63	
Ether extract	2.00	
Crude fibre	10.00	

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Ash	5.00	
Nitrogen free extract Gross energy (Kcal/kg)	73.37 3594	
Mineral content (%)		
Calcium	0.58	
Magnesium	0.72	
Sodium	0.49	
Potassium	0.26	
Phosphorus	0.59	
Anti-Nutritional Factors		
Tannins (%)	0.087	
Phytate (%)	0.046	
Saponins (mg/g)	0.994	
Hydrogen cyanide (mg/g)	0.883	

Table 4: True Metabolizable Energy (TME) of Broiler Finisher Chickens Fed Both Raw and Processed *Cassia tora* Seeds

	GE (Kcal/g)	TME (Kcal/g)	TME as percent of GE (%)		
Raw *C. tora*	3.04	2.08	68.42		
Boiled *C. tora*	3.03	2.79	91.17		
Toasted *C. tora* Soaked-and-boiled *C.tora*	3.03 3.06	2.70 2.80	89.10 91.17		

Table 5: Growth Performance of Starter Broiler Chickens fed Raw *Cassiatora* Seed Meal (1 – 4 weeks)

Levels of inclusion of raw *Cassia tora* seed meal						
Parameters	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	T5 (10%)	SEM
Initial weight (g)	38.02	38.02	38.02	38.02	38.02	0.00
Final weight (g)	920.67[a]	910.33[a]	905.67[a]	745.00[b]	680.67[c]	27.49
Daily weight gain(g)	31.52[a]	31.15[a]	30.99[a]	25.25[b]	22.95[c]	1.03
Daily feed intake (g)	70.37[a]	69.98[a]	69.56[a]	61.34[b]	54.23[b]	1.34
Feed: gain ratio	2.23[c]	2.25[c]	2.24[c]	2.43[a]	2.36[b]	0.03
Protein efficiency ratio	1.95[a]	1.94[a]	1.94[a]	1.79[b]	1.84[b]	0.03

[a,b,c] Means with different superscripts in the same row are significantly different ($P<0.05$)

Table 6: Growth Performance of Broiler Chickens fed Raw *Cassiatora* Seed Meal (1 – 8 weeks)

Levels of inclusion of raw *Cassia tora* seed meal						
Parameters	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)	T5 (10%)	SEM
Initial weight (g)	38.02	38.02	38.02	38.02	38.02	0.00
Final weight (g)	2268[a]	2238[a]	2188[a]	1895[b]	1867[b]	54.49
Daily weight gain (g)	39.82[a]	39.29[a]	38.39[a]	33.16[b]	32.65[b]	0.97
Daily feed intake (g)	99.14[a]	98.22[a]	94.08[b]	93.61[b]	93.03[b]	0.96
Feed: gain ratio	2.49[b]	2.50[b]	2.45[b]	2.82[a]	2.85[a]	0.05

Protein efficiency ratio	2.01^{a}	1.99^{a}	2.03^{a}	1.77^{b}	1.75^{b}	0.02

[a,b,c] Means with different superscripts in the same row are significantly different (P<0.05)