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Determination of true metabolizable energy of raw and heat-treated *Cassia tora* seed meal

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Abstract

True metabolizable energy determination of raw and processed C. tora seed meal was undertaken. Fifty (50) arbor acre broiler chicks, reared to 10 weeks were used, out of which fifteen (15) birds were randomly selected for the trial. The birds were weighed, randomly divided into groups A (fed birds) with 12 birds and B (unfed birds) with three birds. Three birds each in group A were randomly assigned to raw and different processes C. tora seed meal viz toasted, boiled and soaked-and-boiled diets, replicated thrice, with one bird per replicate. The birds were placed in individual metabolism cages and fasted for 24 hours. Thereafter each birds in group A were force-fed 25g of raw and processed Cassia tora, returned to their cages and the time recorded, and trays were placed for collection of excreta, after 24 hours. Birds in the control (group B), were subjected to fasting for 48 hours, and their faeces were also collected. All feed and faecal samples were sundried, bulked, milled and analyzed for energy using the adiabatic oxygen bomb calorimetric method. The results showed significant (P<0.05) difference across the mean TME measured between the raw and processed seeds. It was also observed that boiled and soaked-and-boiled processing methods resulted in 92.07% and 91.50% efficiency of energy bioavailability of Cassia tora while toasting method recorded 89.10%. The mean TME values ranged between 2.08Kcal/g for birds force-fed the raw to 2.80 Kcal/g for birds force-fed the soaked-and-boiled seeds. The boiled and soaked-and-boiled seeds had the highest TME values, while the lowest TME value was recorded for raw Cassia tora seeds. In conclusion, processed Cassia tora seeds encouraged better true metabolizable energy than the raw, and are effective, resulting in up to 91% efficiency of energy bioavailability of Cassia tora seeds.

Keywords: true metabolizable energy, Cassia tora, broiler chickens

Description of Problem

Energy is the ability to do work. Metabolizable energy (ME) is the net energy remaining after fecal and urinary energy loss, and it represents the energy available for growth, reproduction and for supporting metabolic processes such as work, respiration and maintenance. ME could be expressed as either apparent metabolizable energy (AME) or true metabolizable energy (TME). Feeding on the other hand, constitutes an important and highest cost input of poultry production, accounting to 70-80% of total cost of production. This is due to competition among humans, industry and farm animals for the same food items as either food, feed or raw materials. Thus, reducing feed cost is a priority for every poultry farmer and animal nutritionist, and the need to explore the incorporation of non-conventional alternative feedstuffs, such as *Cassia tora* seed meal in broiler chickens diet. (1) reported that the seeds of *C. tora* have good potential as alternative source of energy in poultry diet, containing crude protein of 9.63% and could be incorporated

in broiler diet up to 5% inclusion level. However, there is dearth of information on the true metabolizable energy of *C. tora* seeds meal in broiler finisher diets. This study will fill this gap. Since energy is one of the critical needs of broiler chickens, determining the true metabolically available energy content of *Cassia* tora, and relating it to its nutrient composition is the primary objective of this study.

Materials and methods

Experimental Procedures

C. tora seeds were obtained from farmlands around Ahmadu Bello University (ATBU), Bauchi State, Nigeria and processed according to procedures of (5). Feeding technique and period of starvation followed method of (4) described by (6). A total of fifty (50) day old arbor acre broiler chicks was purchased and reared to 10 weeks, out of which fifteen (15) birds were randomly selected for the trial. The birds were individually weighed and randomly divided into groups: A (fed birds) with twelve broiler chickens and B (unfed birds) with three broiler chickens. This was replicated thrice, with one bird per replicate and placed in individual metabolism cages. Three broiler chickens in group A were each assigned to raw and various processed *C. tora* seed meal viz: boiled, soaked-and-boiled and toasted diets. All birds were fasted for 24 hours. Thereafter, birds in group A were force-fed 25g each of raw and processed *Cassia tora* diets, made into slurry by mixing 25g ground feed sample with water and force-fed to the birds. The force-feeding was by means of a glass funnel with a rubber tube attachment, which was gently inserted into the crop of the birds via the esophagus by rotatory movement. The slurry was poured into the funnel and worked down to the crop of the birds with the aid of a glass rod. The tube was withdrawn by reverse rotatory movement. After this, the birds were returned to their cages, with time recorded and trays were placed for collection of excreta. Birds in group B, serving as control were unfed. Exactly 24 hours, the excreta were collected, weighed and sundried. Whereas the three birds in group B, which served as control were subjected to fasting throughout 48 hours of the experiment, and their faeces collected and sundried. All the feed and faecal samples were bulked, milled and analyzed for energy using the adiabatic oxygen bomb calorimetric method. TME of the samples was calculated using the equation described by (4) as follows.

$$\text{TME (kcal/g air dry)} = \frac{(GE_f \times \chi) - Y_{ef} - Y_{ec}}{\chi}$$

Where TME = True metabolizable energy
GE_f = Gross energy of feedstuffs (Kcal/g)
Y_{ef} = energy voided as excreta by fed birds
Y_{ec} = energy voided as excreta by unfed birds
χ = weight of feedstuff fed (g)

All data were subjected to a one-way Analysis of Variance (ANOVA) according to (7) while differences between treatment means were separated using Duncan's Multiple Range Test using computer software IBM SPSS Statistics version 20.0.

Results and Discussion

The results of True Metabolizable Energy (TME) of broiler finisher chickens fed raw and processed *Cassia tora* seeds are shown in Table 1. There was significant ($P<0.05$) difference across the mean of TME measured. Also, boiled and soaked-and-boiled processing methods showed no significant difference ($P>0.05$), resulting in 92.07% and 91.50% efficiency of energy bioavailability of *C. tora* while toasting recorded 89.10%. The mean TME values ranged between 2.08Kcal/g for birds force-fed the raw to 2.80 Kcal/g for birds force-fed

the soaked-and-boiled seeds. The boiled and soaked-and-boiled seeds had the highest TME values, while the lowest TME value was recorded for raw *Cassia tora* seeds. This may be attributed to effect of processing on the seeds. Furthermore, the low mean TME value of 2.08 Kcal/g for birds fed raw *Cassia tora* seed meal may be attributed to the presence of anti-nutritional factors such as tannins, saponins and phytate in the seeds, which inhibits the expression of nutrients (1). (6) observed that trypsin inhibitors of many legumes comprise up-to 30 – 40% cysteine. They argued that if these legumes are properly processed to improve the toxic effect; the trypsin inhibitor content could contribute significantly to the sulphur amino acids during metabolization, which would yield energy. It therefore followed that the higher TME of the boiled and soaked-and-boiled and toasted *Cassia tora* seeds was due to processing. Also, from chemical evaluation of the seeds subjected to different processing treatments, it was observed that processing significantly improved nutritive value of the seeds. This means more available nutrient. The findings of this study was similar to (6) who reported that boiled, soaked-and-boiled processed samples had the highest TME values of 3.19 and 3.22 Kcal/g while the lowest value (1.05Kcal/g) was for raw *Mucuna cochinchinensis*. (3) earlier assessed the effect of processing on the energy values of lima bean and reported that processing significantly ($P<0.01$) influenced metabolizable energy. The result also aligned with (2) that mean TME for raw sword bean (2.3407 Kcal/g) was significantly ($P<0.05$) lower than 2.8167 Kcal/g for cooked, 2.5767 Kcal/g for toasted and 2.6200 Kcal/g for sodium sespioxide (locally called potash or 'akanwu')-cooked sword bean. It was also observed that processing methods significantly decreased the crude fibre content of the seeds. This, according to (6) could affect the TME in two ways. Firstly, the crude fibre is generally a less digestible nutrient component. Secondly, its presence in a feed or feedstuff would reduce the digestibility of other nutrients. So, the decreased crude fibre content of the thermally processed seeds also contributed to the overall general increase in the biologically available energy of the seeds.

Table 1: True Metabolizable Energy (TME) of Raw and Processed *Cassia tora* Seed Meal

	GE (Kcal/g)	**TME (Kcal/g)**	**TME as percent of GE**
Raw *C. tora*	3.04	2.08[c]	68.42
Boiled *C. tora*	3.03	2.79[a]	92.07
Toasted *C. tora*	3.03	2.70[b]	89.10
Soaked-and-boiled *C. tora*	3.06	2.80[a]	91.50
SEM		0.02	

[a,b,c] Means with different superscripts in the same column are significantly different ($P<0.05$); GE= gross energy; GE= gross energy

Conclusion and Application

1. In conclusion, processed *Cassia tora* seeds encouraged better true metabolizable energy than the raw.
2. Also, thermal processing treatments viz toasted, boiled and soaked-and-boiled are effective and can result in up to 91% efficiency of energy bioavailability of *Cassia tora* seeds.

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