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Research Article

Nutritional Potentials of Toasted *Afzelia africana* Seed Meal in Broilers' Diet

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Abstract

An experiment was conducted to evaluate nutritional potentials of toasted *Afzelia africana* seed meal as feed ingredient on performance of broiler finishers. The proximate Analysis, phytochemicals and amino acid profiles of the toasted *Afzelia africana* were carried out and the seed meal was used to formulate four experimental diets at levels of 0%, 5%, 10% and 15% for treatments 1, 2, 3 and 4, respectively on a 35 day feeding trials. One hundred and twenty brooded four weeks old broiler chicks were assigned to each treatment diets at 30 broiler chicks per treatment and were replicated three times to 10 broilers per replicate in a completely randomized design. The proximate results indicated a moisture level of 6.2%, the crude protein content was 28.7%, crude fibre 5.3%, Ether Extractive 12.5%, Ash 2.9% and Nitrogen free extractive 50.6% on dry matter basis. The phytochemical components were Tannin 8.01%, saponins 5.4%, alkaloids 1.3%, flavonoids 11.8%, cardiac glycosides 2.4%, oxalate 8100mg/ 100g, phytate 0.157% and no level of phenol recorded on dry matter basis indicating toxic levels of these components. The amino acid profiles revealed the presence of all the amino acids. The performance of the broilers showed a drop in the average final weight of the broilers by 2448.6g, 2073.33g, 1930g and 1477g for treatments 1, 2, 3 and 4 respectively. The feed intakes were reduced to 181.3 g, 200 g, 154.67 g and 116.67 g per bird per day for treatments 1, 2, 3 and 4 respectively. Average daily weight gain were 44.10, 33.41, 29.43 and 16.31 grams per day for broilers in treatments 1,2,3 and 4, respectively and the feed conversion rate decreased as the levels of the toasted *Afzelia africana* seed meal increased in the experimental diets. It was therefore concluded that *Afzelia africana* seed meal inclusion resulted to extensive deleterious effect on the broilers and suggests that it should not be used for broilers' diet unless further studies on the detoxification of the components are investigated.

Keywords: *Afzelia Africana*; Proximate; Phytochemicals; Broiler Finisher; Detoxification

Introduction

The West African rain forest areas are endowed with wonderful vegetation unequalled by any other continents of the world. Most of the vegetative species are either underutilized or are not utilized at all. Some of these plant species are used as vegetables, wooden species and as browse to livestock species and the seeds or nuts used only as less value to human utilization. These vast species have added wide range of animal feed resources for which the West African rain forest areas are blessed with in the form of grains, oil seeds and agro-industrial products and by- products which could be used in the formulation of good quality livestock feeds.

Some of these plant products (seeds, leaves and barks) are allowed to waste and are underutilized or unharnessed. These seeds are often times toxic to animals and are fibrous or contain anti-nutritional factors as could be the case with *Albizia saman, Mucuna* species*, Canavalia* species and some leaf species [1-4].

The efforts to determine the biosafety status of some of these plant species have attracted the attentions and interests of Nutritionists and Biochemists on possible treatments such as, heat treatment (cooking, roasting and toasting), the use of enzymes and probiotic to inactivate some anti-nutritional substances to enhance their utilization.

Despite all these efforts, there is still low capacity feed resources utilization which could be linked to inadequate information based on location and localization of feed resources, processing, preservation or storage and quality assessment or enhancement. This is associated with long time dependence on conventional and imported feed resources by key players in livestock industry while potentially affordable, available unconventional local feed resources suffer a great neglect and low patronage resulting to the wide gap on the animal protein intake of Nigerians short of the WHO's average protein intake requirement [5].

To sustain the livestock and poultry industries, it is very urgent to look for readily available plant protein-energy source that are affordable and has low human value that can replace either totally or partially the conventional feed resources like Soya bean or maize for continued and consistent production of meat, milk, egg and other animal products and by-products for mankind [6].

Forage trees and shrub-like legumes are inexhaustible nutrient sources contributing feeds of good quality, that improve the animal diet and reduce the use of concentrates in agricultural exploitations [7].

Legume and oil seeds used in preparation of diets abound in Nigeria. Seeds of castor, coconut, dikanut, groundnut, melon, African oil bean, palm kernel, soya bean, *vigna* and *phaseolus* bean cultivars and a wide variety of seeds in the *Leguminoceae* family are used in the preparation of diets and for humans and livestocks to improve diets [8-11].

Cereals and Legumes in the developing countries supply the energy and vegetable proteins requirement of both humans and livestocks [12]. Also, leaves of *Alchornia cordifolio* and *Azachirchta indica* could be of value to poultry diets [2]. Legumes are important ingredients in human diets in many parts of the world due to their high protein and starch contents [13].

The scarcity and high cost of feed ingredients despite efforts by livestock industry stake-holders has resulted to high cost of finished poultry products. The quest for high quality but affordable animal feed ingredients has continued to be the concern of nutritionists, government and bodies charged with the responsibilities of food and nutrition in different parts of developing economies.

This problem has been blamed more on lack of information on the composition and utilization of many of the various sources of feed ingredients indigenous to the tropical/sub Saharan Africa.

The unavailability of animal protein origin, inadequate quantities makes the use of protein rich legumes to be essential alternatives in poultry nutrition [14].

Groundnut cake (GNC) and soya bean meal (SBM) which used to play major and significant roles in poultry nutrition have suddenly become scares in view of their high demand resulting to the closure of most poultry farms. Perhaps, that is why [15,16] reported that in Nigeria, poultry industry has been facing a lot of challenges due to numerous constraints among which is high cost of poultry feed. Feed alone accounts for over 70% of the total cost of production out of which 50% is expended on protein and energy source. They further observed that the unprecedented cost of feed ingredients has made the cost of poultry products very high. The industry is becoming unattractive and hence unable to supply the much needed animal protein on the table of an average Nigerian. The situation is worsened by the competition between man and livestock industries for the major feed ingredients such as maize and soya beans. Also high cost of conventional protein feedstuffs such as groundnut cake, fish meal, soya bean meal, etc, has led to the closure of most poultry farms.

This situation calls for the obvious need to exploit and expand the production and utilization of other relatively unknown non-conventional and cheaper legumes as sources of protein in poultry feeds. Legume pastures have been projected as economically viable alternative for proteins and calories in developing countries [17]. Few substitutions with native legumes is viable and provides additional proteins, minerals and energy in dry seasons and improves the overall nutritional status of developing countries [18].

Legumes are plant-based proteins for humans and livestock. The underutilized ones are inexpensive and attractive sources of protein than conventional sources such as soya bean (*Glycine Max*), groundnut (*Arachis hypogea*) and animal-based proteins [18]. It has become necessary therefore, to investigate into some of the wild leguminous plants, to enable us harness their food and nutrient potentials, reduce the demand for and the high cost of conventional protein concentrates, increase concentrate availability and hence increase supply of poultry products to man.

Some underutilized wild leguminous plants have been explored for their nutritional values and *Afzelia africana* is one of such legumes whose potentials has not been fully harnessed by nutritionists and livestock industries. It can be grown in all parts of the country. Presently it has only attracted local recognitions in

areas it is used as soup thickening ingredient and the leaves and bark as medicinal materials for various ailments.

The tree is known in the major Nigerian languages of Igbo, Hausa and Yoruba as "Akparata" or "Akpalata", "Kawo" and "Apa", respectively. *Afzelia africana* belongs to the family *Leguminoceae* and sub family *Caesalpinaceae* [19,20]. The tree is a semi deciduous wild plant, abundant in the savanna, fringing forest and the drier parts of the forest regions of Africa. Its fruiting period is between December and March every year. It is one of the most widely distributed species in Africa. It is found in Senegal and predominantly in the Eastern part of Nigeria West Africa; Sudan, Uganda and Tanzania in the East. Very small quantities of the seeds are traditionally used as condiment (soup thickening ingredient) by few Nigerian communities, while large quantities are allowed to waste in the fields. The use of the leguminous seed (*Afzelia africana*) as protein source in livestock feeds is not widely reported in the literature to the knowledge of the researchers, there is little or no information on *Afzelia africana* seed meal as a diet ingredient for poultry (monogastric) production.

The un-affordability and unavailability of the conventional protein sources (groundnut cake (GNC), soya bean meal (SBM)) for poultry feeds production to enhance increased poultry products has necessitated the need for conducting this study. This study therefore, evaluates nutritional potentials of toasted *Afzelia africana* seed in broiler diet.

Objective of the Study

The objectives of this study include: To determine the proximate and phyto-chemical composition and amino acid profile of Toasted *Afzelia africana* seed meal.

Justification

This study will uncover the true value of *Afzelia africana* seed as feed ingredients in broiler diets. The findings may enable poultry farmers (producers) to start using *Afzelia africana* seed meal as feed ingredient or not.

If positive result is achieved, it is believed it will prompt scientists to research into indigenous leguminous plant seeds that are considered not useful now. It may also attract agro-allied industries, other industries, nutritionists and government agencies to release grants for further researches, on not only *Afzelia africana* but other indigenous legumes. The positive outcome of this research if publicized, will boost morale, arouse and ginger interest in crop farmers going into the cultivation of *Afzelia africana* on a controlled large scale.

More importantly, it will forestall the tendency of the plant going into extinction and in so doing it will help increase the supply of the seeds and consequently further force down the market price of poultry feed for increased productivity.

Materials and Method

Experimental site

The experiment was carried out in the Teaching and Research Farm of Imo State University, Owerri and also in the Food Chemistry/Analysis Laboratory of the Department of Food Technology of Akanu Ibiam Federal Polytechnic, Unwana Ebonyi State both in South East Nigeria.

Sources, preparation and processing of experimental diet

The matured raw seed of *Afzelia africana* were bought from Eke Market in Afikpo North LGA and Ọnueke Market in Ezza Local Government Area, Ebonyi State, Nigeria.

After purchase and collection, the seeds were inspected and the defective ones discarded. The seeds with the waxy orange cup like structure at the base of the seed were traditionally processed by being toasted at a temperature of 100°C for about 25 minutes until they started to crack open and the white endosperm turned crispy brown. The toasted seeds were cracked/ decorticated manually with the use of wooden pestle.

The toasted endosperm were hammer milled to particle size, which can pass through 0.02mm sieve in order to obtain the toasted *Afzelia africana* Seed Meal (TAASM) that were used for the formulation of the experimental diets. This method was adopted by [21].

The Toasted *Afzelia africana* Seed Meal (TAASM) sample so produced was taken to the laboratory for phyto-chemcial analysis, amino acid profile test and proximate analysis prior to ration formulation according to Association of Official Analytical Chemist [22] to determine the crude protein, Ether Extract, Crude Fibre, Ash content, Moisture and carbohydrate.

Experimental diets

The TAASM was used to formulate four (4) broiler finisher diets at inclusion levels of 0.00%, 5.00%, 10.00% and 15.00% representing T_1 (control) conventional diet which did not contain the *Afzelia africana* seed meal while diets T_2,T_3 and T_4 contained 5.00%, 10.00% and 15.00% of toasted *Afzelia africana* seed meal (AASM) in partial replacement of soya bean meal respectively. The ingredient compositions of the diets are shown in Table 1.

Ingredients	T_1 (0.00%)	T_2 (5.00%)	T_3 (10.00%)	T_4 (15.00%)
Maize (yellow maize)	55	55	55	55
Afzelia Africana	0.00	5.00	10.00	15.00
Soya bean	15.00	10.00	5.00	0.00
Groundnut cake	10.00	10.00	10.00	10.00
Palm kernel cake	3.00	3.00	3.00	3.00
Brewers dried grain	3.00	3.00	3.00	3.00
Wheat bran	3.00	3.00	3.00	3.00
Fish meal	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00
Blood meal	3.00	3.00	3.00	3.00
Vitamin mineral premix	0.25	0.25	0.25	0.25
Common Salt	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25
TOTAL	100	100	100	100

Table 1: Ingredient Composition of the Experimental Diets**.**

Experimental Birds and Design

A total of one hundred and twenty (120) Marshal strain, finisher broilers, 28 days old with an average weight of 904g were used for the experiment. The birds were placed in deep litter pens. Prior to the commencement of the experiment, the birds were fed commercial finisher diet (*Afzelia africana* free diet) for 7 days.

On the 8th day, the broilers were randomly divided into four (4) experimental groups of thirty (30) broiler birds and each group was randomly assigned to one of the experimental diets in a completely randomized design (CRD).

Subsequently, each group was further replicated into three (3), consisting of ten (10) birds per replicate. Each replicate was kept in a compartment measuring 2m x 2m. Feed and water was provided ad-li-bitum throughout the experimental period. Prophylactic treatments against Newcastle disease, fowl pox and Gumboro were given to the birds. The birds were also given drugs against coccidiosis as they were also dewormed. The feeding trial lasted for 35 days. The broilers were weighed at the commencement of the experiment and weekly thereafter. Routine washing of drinkers, cleaning and proper litter management to prevent infection and spread of diseases were observed. Multivitamins stress reducers were given.

Data collection

The data collection commenced as soon as treatment diets were introduced. Feed intake was recorded daily and the birds weighed weekly after the initial body weight was taken. Feed intake was determined by weighing the feed offered and the left over the following day. The difference between the two values was taken as the feed consumed. Feed conversion ratio was determined by dividing average feed intake by average daily body weight.

Proximate analysis

Standard methods according to AOAC (2000) for the determination of the proximate parameters (which included: moisture content/total solids, ash content, fibre content, crude fat/lipids, protein content, and total carbohydrates [by difference]) were employed and the results noted.

Data analysis

The data collected from the study were subjected to analysis of variance (ANOVA) by Steel and Torrie (1980) while significant treatment means were separated using Duncan's New Multiple Range Test (DUNMRT) as outlined by Obi, (2002).

Results

The result of the proximate composition of toasted *Afzelia africana* is presented in Table 2. The result revealed that moisture content was 6.2% without browning effect and ether extractive 12.5%. The crude protein content was 28.7%. This level of protein could appreciate if the lipid content of the seed is extracted. The crude fibre content and the total ash which is the mineral content is 5.3% and 2.9% respectively and the nitrogen free extractive is 50.6%. The proximate analysis was done on dry matter basis.

Nutrient	Amount (%Dm)
Moisture	6.2
Crude protein	28.7
Crude fibre	5.3
Ether extractive	12.5
Ash	2.9
Nitrogen-free extractive	50.6

Table 2: Proximate composition of Toasted *Afzelia africana* seed meal.

Dm = Dry matter basis

At 6.2% moisture content, he toasted *Afzelia africana* seeds can store very well and over a very long period of time and this can ensure storability and availability even at the off season period.

Amino acid profile of toasted *Afzelia africana* seed meal

S/N	Group name	Amount (g/100g protein)
1.	Glycine	3.81966
2.	Alanine	4.24524
3.	Serine	2.66257
4.	Proline	2.74162
5.	Valine	3.47853
6.	Threonine	3.42590
7.	Isoleucine	3.26236
8.	Leucine	6.26319
9.	Aspartate	8.95398
10.	Lysine	4.07628
11.	Methionine	1.47835
12.	Glutamate	11.33029
13.	Phenylalanine	4.24347
14.	Histidine	2.49853
15.	Arginine	6.75032
16.	Tyrosine	2.51570
17.	Tryptophan	6.79751
18.	Cystine	1.24996
	Total	**72.99602**

Table 3: The result of the amino acid profile of Toasted *Afzelia africana* Seed meal.

The result of the amino acid profile revealed that toasted *Afzelia africana* has a high level of glutamate, leucine aspartate, arginine and tryptophan with other amino acids in moderate and low levels. The result revealed that the seed when toasted has almost all the amino acids and importantly, it has all the eight essential amino acids, which therefore makes it a very good source of protein.

Conclusion

The nutritional potentials of *Afzelia africana* make the seeds attractive for use as a source of protein both for human consumption and animal production and should therefore be exploited for more extensive use in human nutrition as well as for the production of livestock, especially broiler birds.

Recommendation

It is strongly recommended that studies on the toxicological potentials of *Afzelia africana* be investigated before incorporating it fully into the feed for the broiler birds.

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