

Phytochemical and Nutritional Evaluation of Raw and Fermented *Alchornea cordifolia* seed meals on the performance of Broiler Chicks.

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Abstract

Phytochemical and feeding values of raw and fermented Alchornea cordifolia seed meals were investigated. Raw and fermented seed meals were screened for some phytochemical compounds and also tested on the performance of starter broilers. The meals were included in broiler starter diets at 10% raw and, 10 and 20% fermented, respectively. The diets were fed from 0-28 days of age. Raw Alchornea seed meal contains phytic acids, tannins, saponins, cardiac glycosides, steroids, flavonoids, alkaloids and anthraquinone. Fermenting the seed meal caused 56.2% reduction in the phytic acid content and totally eliminated its anthraquinone content. With 10% raw Alchornea seed meal, broilers grew significantly slower, gained 60.1% of control but feed intake was not statistically different. Inclusion of 10% fermented meal resulted in better weight gain, and feed conversion ratio than the raw seed meal and by 28-days, weight gain, feed intake and feed conversion ratio were not statistically different from the control. At 20% dietary level, fermented Alchornea seed meal, promoted much better growth and efficiency than raw but the values were less ($p < 0.05$) than control. It is concluded therefore that fermentation partially destroyed the anti-nutritional factors present in Alchornea seeds; thus allowing successful use of 10% fermented seed meal in starter broiler rations. Higher level of the fermented seed meal reduced performance although the result was much better than in the raw seed meal.

Key words: *Alchornea* seed, fermentation, toxic factors, broilers, performance

Introduction

Poultry meat from broiler is the cheapest form of carcass meat and the branch of animal production with the most consistent and rapid growth in most countries of the world. However, the fact that all Nigerian poultry enterprises use cereal grain as the basis for their feeding system makes the future outlook far from being secured. This is because the world grain production is on the decline due to the decreasing yield caused by reduced soil humidity, resulting from higher temperatures in all the major producing countries (Preston 1995). Again increased costs of ecological pressures against the

use of agro-chemical inputs and the decision to reduce subsidies to producers and exporters of grain in many countries both compounded the problem of increased production. There is also a serious competition between humans and animals over the few available cereal grains in Nigeria. This has resulted in increased prices of cereal grains used for producing livestock feeds. The survival of the poultry industry will therefore depend on finding a comprehensive solution to the problem of over-dependence on cereal grains and cereal by-products.

Many authors (Onwuka *et al*, 1989;D'Mello, 1992; Aletor and Omodara, 1994; Okoli *et al* 2002., Udedibie and Opara 1998, Oji and Isilebo, 2000) have reported the use of leaf meals from browse plants in the feeding of non-ruminants. Other alternative sources of protein-rich and energy-rich crops such as leaves of many trees and shrubs, several water plants, sugar canes, African oil palm rejects, sweet potato tubers, banana, plantain, fruits and so on, have been proposed. Some of these alternatives according to Preston (1995) are capable of yielding very much higher protein and more equivalent energy to that of the expected cereal grains. However, many browse plants produce fruits and seeds that are little known and used in the feeding of livestock. One of such browse plant is *Alchornea cordifolia*.

A. cordifolia is a popular browse plant that forms a good proportion of the ever green vegetation of the humid tropical zone of southern Nigeria (Udedibie and Opara, 1998). The plant is also found in the Republic of Guinea (Sugiyama and Koman, 1992) and Japan (Huffman 2002). It is locally known as “Ubobo” in the Ibo speaking tribe of south eastern Nigeria. It produces large quantities of seed in the wild. The leaves are commonly used by local villagers for the feeding of their small ruminants (Udedibie and Opara, 1998, Okoli *et al*, 2002). It is also used by local inhabitants for the cure of many disease of man (Oliver, 1980, Lamikara, *et al*, 1990; Iwu 1993). Local human inhabitants in Guinea use the pith and leaves as antiseptic and anti-cough agents (Sugiyama and Koman, 1992).

Gorillas have been documented to eat the fruit of *A. cordifolia* in Equatorial Guinea (Sebater, 1977) while Chimpanzee

consume its pith and fruit in the Republic of Guinea (Sugiyama and Koman, 1992). Meanwhile not much is known about the phytochemical compositions as well as the feeding value of the fermented seeds for poultry.

Preliminary study on the proximate composition of the raw and fermented seeds showed that the seed meal contains about 13% crude protein and 14 Mj/kg energy (Onwuka 2006, Okechie, 2006). The use of the raw seed meals in broiler starter diets fed 0 - 28 weeks (Onwuka 2006) and fermented seeds in finisher diets fed 5 - 8 weeks (Okechie 2006), both depressed growth and feed conversion ratio at 5-15% and 10-20% dietary inclusion levels respectively. Sebater (1977) reported the presence of the alkaloids: alchornine and alchornidine in *Alchornea cordifolia* plant.

The objective of this study was therefore to determine the phytochemical composition of raw and fermented *Alchornea* seed meals as well as evaluate the effect of the seed meals on the performance of starter broilers.

Materials and Method

Source of Seed and Processing

Matured *Alchornea* seeds harvested from the wild were sun dried for 6 days. The seeds were then removed from the stalks and ground into meal using hammer mill. The meal was divided into two batches. The first batch was left as raw *Alchornea* seed meal (RASM) while the second batch was soaked in water for 48 hours under room temperature, drained into a jute bag, pressed to squeeze out excess liquid, and allowed to stand for 12 hours under pressure. The meal so produced was then sun dried for 3 days on a concrete slab and stored as fermented *Alchornea* seed meal (FASM).

Alchornea on broiler performance

Table 1: Ingredient composition of the experimental diet fed 0 -28 days

Ingredient	Control 0.0%	RASM 10%	FASM 10%	FASM 20%
Maize	55.0	45.0	45.0	35.0
ASM	-	10.0	10.0	20.0
Soybean meal	25.0	25.0	25.0	25.0
Brewers dried grains	5.0	5.0	5.0	5.0
Wheat offal	2.0	2.0	2.0	2.0
Palm kernel cake	4.0	4.0	4.0	4.0
Fish meal	5.0	5.0	5.0	5.0
Bone meal	3.0	3.0	3.0	3.0
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vit/Mineral Premix ¹	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0
Calculated Composition				
Crude protein	21.45	21.95	21.95	22.15
Crude fibre	4.39	4.63	4.63	4.87
Ether extract	4.19	4.28	4.28	4.36
Calcium	1.32	1.32	1.32	1.30
Phosphorus	1.00	0.98	0.98	0.95
Lysine	1.13	1.09	1.09	1.08
Methionine	0.42	0.39	0.39	0.37
ME (kcal/kg DM)	2629.80	2537.90	2537.90	2456.20

¹To provide the following per kg of feed: Vitamin A, 10,000iu; vitamin D₃, 2000iu; vitamin E, 5iu; vitamin K, 2mg; riboflavin, 4.2mg; vitamin B₁₂, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, 0.5mg; choline, 3mg; mg, 56mg; Fe, 20mg; Cu, 1.0mg; Zn, 5.0mg; Co, 1.25mg; iodine, 0.8mg.

Phytochemical Analysis

Samples of the raw and fermented seed meals were packaged and sent to the National Veterinary Research Institute Vom, Nigeria for the determination of the presence of cyanide, phytic acid, saponin, anthraquinone, cardiac glycosides, steroids, flavonoids, tannins and alkaloids.

Experimental Diets

Four experimental starter broiler diets were formulated, such that the diets contained 10% RASM and, 10 and 20% FASM, respectively. The control diet contained no *Alchornea* seed meal. The ingredient composition of the diets is shown in table 1.

Experimental Birds and Design.

One hundred and twenty (120) day-old Ross Strain broiler chicks were used for the experiment. The birds were divided into four groups of thirty birds each. Each group of 30 birds was subdivided into three sub-groups of 10 birds. The four dietary treatments were randomly assigned to each of the 12 experimental units in a complete randomized design

(CRD). The birds were housed in pens measuring 2m x 2m. Wood shavings were used as the litter material. The pens were covered with black polythene to control wind and heat. Heat and light were provided for the first 14 days with stoves and electric bulbs. Feed and water were provided *ad libitum*. The experiment lasted 28 days.

Data collection and Analysis

The initial body weight, weekly body weight and feed intake of the birds throughout the experiment were recorded. The chick performance data on weight gain, feed intake, feed conversion (FCR) and survivability were calculated from the records of body weight, feed intake and mortality respectively.

Data on performance were subjected to Analysis of Variance ANOVA (Steel and Torrie 1960). Differences between treatment means were separated by applying the standard error of means (Snedecor and Cochran 1978). Statements of statistical significance were based on ($p < 0.05$).

Table 2: Phytochemical composition of raw and fermented *Alchornea cordifolia* seed, meals.

Composition	Raw	Fermented
Phytic acid	973.8mg/100g	547.4mg/100g
Cyanide	- ve	- ve
Saponins	++ ve	+ ve
Anthraquinone	+ ve	- ve
Cardiac glycosides	++ ve	+ ve
Steroids	++ ve	+ ve
Flavonoids	++ ve	+ ve
Tannins	++ ve	+ ve
Alkaloids	++ ve	+ ve

-ve - Negative
+ve - Positive

Results

The result of the phytochemical screening of raw and fermented *Alchornea* seed meals is shown in table 2. Both raw and fermented seeds were devoid of cyanides but contained saponins, tannins, cardiac glycosides, steroids and alkaloids. Fermenting the seed meal decreased the phytic acid content of the raw seed and eliminated the anthraquinone content.

Birds fed 10% RASM diet had a statistically similar ($p>0.05$) feed intake with that of other treatment groups (Table 3). Birds fed 20% FASM diet had a higher ($p<0.05$) feed intake than the control. Weight gain of birds on the control diet was highest but compared statistically ($p>0.05$) with that of birds fed 10%FASM diet but the value however differed ($p<0.05$) from those fed 10% RASM and

20%FASM diets. Birds fed 10%RASM diet recorded the lowest weight gain and weighed only 60.08% of control.

Fermented *Alchornea* seed meal at 10% level, slightly depressed weight gains, but by 28 day, body weight of broilers in this treatment did not differ ($p>0.05$) from control. As with the RASM fed at 10%, feed intake, and feed conversion ratio of broilers fed 10% FASM did not differ from the control. When 20% FASM was used, body weight decreased ($p<0.05$) with increased feed intake. There were marked decrease ($p<0.05$) in feed conversion ratio in birds fed 10%RASM and 20%FASM diets. Mortality values were higher in birds fed 10%RASM and 20%FASM diets than the control.

Table 3: Performance of broilers fed *Alchornea* seed meal diets (0 -28 days).

Parameters	Control 0.0%	Raw 10.0%	Fermented 10.0%	Fermented 20.0%	SEM
Av. Initial wt (g)	31.0	31.0	31.0	31.0	2.30
Av. Final wt (g)	500.4 ^a	313.4 ^c	424.7 ^{ab}	342.0 ^{bc}	28.82
Av. Wt gain (g)	469.4 ^a	282.4 ^c	393.7 ^{ab}	311.0 ^b	38.82
Av. Feed intake (g)	1145.7 ^b	1321.8 ^{ab}	1221.4 ^b	1504.9 ^a	71.73
Feed conversion ratio	2.44 ^b	4.68 ^a	3.10 ^b	4.83 ^a	0.45
Mortality ¹ (%)	15.4 (4)	41.7(5)	-	28.6 (4)	-

abc. Means within a row with different letter superscripts are significantly different ($P<0.05$).

¹Numbers of mortalities are presented in parenthesis

Discussion

No systematic research has been done on the phytochemical compounds present in raw or processed *Alchornea* seeds. However, the plant parts have been reported to contain alkaloids (Huffman 2002), terpenoid (Farmoi, *et al* 2003), cardiac glycosides, saponnin and phenolic compounds (Ogundipe, *et al* .1999).

In the present study, it was found that both raw and fermented *Alchornea* seed meals contain some specialized secondary plant biomolecules: saponnins, tannins, alkaloids among others (Table 2). In relation to raw *Alchornea* seeds, fermentation reduced the phytic acid level and eliminated the anthraquinone content. Little difference was obtained between raw and fermented seed meals in the other anti-nutritional factors detected, which indicated that fermentation neither completely destroyed nor totally eliminated most of the toxic factors.

The inclusion 10%RASM in broiler starter ration resulted in a reduction in body weight through 28 -day of age. The result agreed with the report by Onwuka (2006) on broiler chicks fed raw *Alchornea* seed meal. Although the nutritional value of the seeds have not been studied extensively in poultry, a large part of its negative effect on performance could be blamed on one or more of the toxic factors identified in the raw and processed seed meals (Table 2).

Feed intake was less severely affected by RASM than growth. Apparently the major nutritional effect of the toxic factors in *Alchornea* seed is to inhibit the metabolic processes leading to growth. Thus, the marked growth depression from feeding *Alchornea* seeds cannot be blamed on poor feed intake. This suggests that the effect of *Alchornea* seed meal on metabolic processes should be further

examined. Feed conversion ratio was negatively affected at 10% level of RASM, thus reflecting its depressive effect on growth. This finding is in agreement with that reported by Onwuka (2006). The fermented *Alchornea* seed meal depressed growth except that at the end of the experiment at 28-day of age, broilers fed the 10% level grew as well as control. This suggests that fermentation reduced some growth depressing factors found in the raw seeds. Also fermentation might have influenced the nutritive value of *Alchornea* seeds hence the slightly improved performance of birds fed 10% FASM compared to 10% RASM. It is also clear from the result that FASM was more tolerable and had less drastic effect on growth compared to the raw seed.

Birds fed 20% FASM recorded the highest feed intake but poorest feed conversion ratio. Since the effects of fermented *Alchornea* seed has not been studied in any specie including chickens, it is not known what factors increased feed intake but depressed growth and feed conversion ratio at 20% level. The improved feed intake at the expense of growth and feed conversion ratio at 20% dietary inclusion level of fermented *Alchornea* seed may be partially explained by a reduction in anti-nutritional factors and an attempt by the birds to satisfy their energy requirement which may have caused them to eat more of the feed. However, the continued presence of anti-nutritional factors in the fermented seeds (Table 2) may explain the persistently depressive effects of the seed meal diets in broiler performance especially at high dietary inclusion level of 20%

.Conclusion

It is concluded that both, raw and fermented *Alchornea cordifolia* seed meals contain anti-nutritional substances.

Forty-eight hours soaking of the seed meal in water prior to 12 hours fermentation in jute bag was not effective in destroying all the toxic factors. Inclusion of 10% FASM improved broiler performance comparable to control. Since *Alchornea* plant forms a good proportion of the vegetation of southern Nigeria and yields heavily in seeds in the wild, detailed studies on its nutritional and toxic properties are worthwhile. Many factors remain uninvestigated regarding the potential use of the seeds in animal diets such as conditions of fermentation and processing methods. Efforts aimed at improving the nutritional and toxic characteristics of *Alchornea* seeds are worthwhile.

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