CHEMICAL AND NUTRITION EVALUATION OF THE SEED KERNEL OF *BALANITES AEGYPTIACA*

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ABSTRACT

The seed kernel of *Balanites Aegyptiaca* has been evaluated chemically and nutritionally. The crude protein, crude fat and total carbohydrate content of the seed kernel were 35.26g, 48.82g and 12.56g per 100g dry weight respectively. The caloric value was 630.66cal per 100g dry weight. The seed is a rich source of potassium, calcium and iron. Amino acid analysis of the seed showed high levels of leucine, Isoleucine, threonine, cycteine, phenylalanine and lysine. Metheonine seemed to be the limiting amino acid with a chemical score of 34.10%. The protein efficiency ration (PER) and net protein ratio (NPR) for the boiled seed kernel (0.18 and 1.09 respectively) were significantly higher ($P<0.05$) than the values for unboiled seed kernel (-0.61 and 0.40 respectively). The seed kernel may be a good source of protein in livestock feeds.

KEY WORD: *Balanites aegyptiaca*, seed kernel, chemical composition, Amino acid content

INTRODUCTION

The prevailing hash economic situation in most West African countries including Nigeria has hindered the importation of feed ingredients leading to a sharp decline in poultry and livestock production (Aletir, 1989, Ologhobo, 1987). This stimulated the search for locally available feed products. Various studies have assessed the substitution of fish-meal with blood-meal (Offiong *et al.*, 1982), groundnut cake with cotton seed meal (Ikurior and Fetuga, 1985), fish-meal with soya bean cake (Aletir, 1989) and groundnut cake with soya bean cake (Tewe and Ologhobo, 1986) in feeds for poultry and livestock.

Ologhobo (1987) reported high protein retention values for grower and finisher poultry rations supplemented with autoclave lima beans. The seed kernels of *Balanites aegyptiaca* are of particular interest because they represent a cheap source of protein for poultry and livestock feeds (Burkill, 1985).

Balanites aegyptiaca (Aduwa in Hausa) is a desert plant widely distributed in Northern Nigeria (Burkill, 1985).

The seed kernels are nutritious and normally obtained by hard cracking. In this study, cassava starch was supplemented with raw and boiled aduwa seed kernels and fed to rats.

The purpose of this study was to evaluate both by chemical analysis and by feeding trial experiments on rats the nutritive value of the kernel of aduwa and the possibility of incorporating the seed in livestock feed as a source protein.

MATERIALS AND METHODS

(a) Preparation of Aduwa Seed Kernel

Aduwa seeds were obtained from the kernel by hand cracking. The seeds were divided into two portions. One portion was boiled for 20 minutes, washed with cold water, air dried and milled. The other portion was not boiled but was ground into fine powder and stored in an air tight polythene bag.

(b) Proximate Chemical Analysis

The proximate chemical analysis was determined by (AoAC(1975) procedure. The ash content was determined by incineration of a known weight of the sample at a temperature of 550°C for 12 hours. The lipid was determined by soxhlet extraction of a known weight of the sample with petroleum ether (b.pt 60-80°C for 12 hours. Crude protein was determined by the macrokjeldahl method. The carbohydrate content was obtained by the difference method. Crude fibre was determined by the methods of Joslyn, (1970). Oxalic acid was determined by the modified methods of Dye (1956) while cyanogenic glycosides was determined by the alkaline picrate method. Phytic acid content was determined by the modified method of McCance and Widowson.

Amino acid content was determined by the method of Spackman using a TSB amino analyser. Mineral content was determined using atomic absorption spectrophotometry.

(c) Preparation of Experimental diests

Four experimental diets were prepared as shown in Table 1.

TABLE 1:

Ingredient	Group			
	1	2	3	4
Cassava starch	85	56.74	56.74	75.0
Aduwa Seed (raw)	-	28.26	-	-
Aduwa seed boiled	-	-	28.26	-
Casein	-	-	-	10.0
Mineral-vitamin Mix*	5.0	5.0	5.0	5.0
Groundnut Oil	10.0	10.0	10.0	10.0

Pfizer (Agricare mix 0.25%) containing:
Vit. A, Vit. D3, Vit. E, Vit. K, Riboflavin,
Vit. B12, Panthothenic acid, nicotinic acid,
chlorine cl, folic acid, selanium, phosphorus,
calcium iodine, copper, manganese, zinc and iron.

The diet in each case was homogeneously mixed, made into pellets and dried. These were used in feeding experiments.

(d) **Animal Feeding**

A total of 24 male and female weanling albino rats weighing between (19.8 - 42.8g) were purchased from the Nigeria Institute of Trypanosomiasis Research, Vom. The rats were housed in stainless steel individual metabolic cages and stabilized on standard rat feed for three days before commencing the feeding experiment. The rats were randomly divided into four groups of six rats/group with two rats in each cage. Rats in group 1 were fed diet 1, Rats in group 2 were fed diet 2, while those in groups 3 and four were also fed diets 3 and 4 respectively. Water was given ad-libitum for the 28 days experimental period. Body weight, water and feed consumption data were obtained three times a week and collection of faeces made every two days for the last seven days of the experiment. Urine and faeces of individual rats were collected and appropriately treated for urinary Nitrogen and faecal Nitrogen determination.

At the end of the experimental period, Protein Efficiency Ratio (PER), Feed Efficiency Ratio (PER), Net Protein Ratio (NPR), Efficiency of Food conversion (EFC) and Biological value (BV) were calculated from the changes in body weight and protein intakes of the experimental animals.

(e) **Statistical Analysis**

Statistical analysis of data was by standard procedure (Kelly and Onyeka, 1992) using 5% level of significance.

RESULTS

The proximate chemical composition, elemental composition, anti-nutrient composition as well as the amino acid analysis are presented in Tables 2 - 5 respectively, while the growth rate, feed consumption rate and protein efficiency ratio are presented in tables 6 - 8 respectively. The moisture content is low, crude protein and crude fat values are high (Table 2). The mineral composition shows that the seed kernel is rich in potassium, calcium, magnesium and iron (Table 3). The seed kernel has a low level of oxalate, cyanide and Phytic acid (Table 4).

The amino acid composition (Table 5) shows that, the seed is rich in leucine, threonine, phenylalanine, cysteine and lysine. Methionine is the limiting amino acid in the seed kernel.

The gain in weight of the rats fed cassava plus boiled aduwa was significantly higher than ($P<0.01$) either those rats fed cassava or cassava plus raw aduwa. The group three rats gave a positive PER, FER, and EFC and significantly higher ($P<0.05$) NPR than those of group 2 (Tables 6 and 7).

Table 2: Proximate Composition of Aduwa Seed Kernel (% dry weight)

Moisture % w/w	7.58
Dry matter	92.42
Crude protein	35.26
Crude fat	48.82
Crude fibre	10.06
Ash	3.35
Nitrogen free extract	2.50
Phosphorus	0.36
Caloric value (kcal)	630.66

Values are means of triplicate determination ±SD

Table 3: Elemental Composition of Aduwa Seed (mg/100 dry matter)

Mineral Element	Value mg/100g DM
Na	5.27±0.35
K	636.1±1.27
Ca	150.65±0.92
Mg	88.7±0.99
Zn	2.86±0.08
Fe	4.84±0.04
Mn	1.92±0.04
Cu	1.18±0.25
Pb	ND
Cd	ND

ND = Not detectable
Mean ± SD = Two determinations.

Table 4: Level of anti nutrients in Aduwa Seed Kernel

1.	Cyanide	15.58±0.5 PPM
2.	Oxalate	0.851±118.5g/100g
3.	Phytic acid	21.33MG/100±1.61

Values are means of 3 separate determination ± SD

Table 5: Amino Acid Composition of Aduwa Seed Kernel (g/16gN)

Amino Acid	Value	Chemical Score	FAO Ref. Value
Isoleucine	3.47	82.62	4.2
Leucine	6.47	154.05	4.2
Lysine	5.00	119.05	4.2
Methionine	0.75	34.10	2.2
Threonine	4.25	151.79	2.8
Phenylalanine	4.61	164.64	2.8
Valine	3.29	78.33	4.2
Tyrosine	2.75	98.21	2.8
Cysteine	2.52	126.00	2.0
Tryptophan	ND		
Arginine	2.70		
Histidine	1.99		
Alanine	3.50		
Serine	4.29		
Glycine	4.10		
Glutamic acid	8.91		
Aspartic acid	8.29		
Proline	2.78		

ND = Not determined

Table 6: Mean Weight gain/Rat

Group	Mean weight gain (g)
1	-8.36±1.72
2	-12.50±1.41
3	7.20±1.61
4 (control)	16.20±1.79

Table 7

Group	Weight in gm ± SD	Amount of Protein in g ± SD
1	6.10±2.02	0.26±0.09
2	6.77±1.86	0.71±0.20
*3	11.17±2.54	1.42±0.32
4 (control)	15.87 ± 2.60	1.74±0.28

*P<0.05 vs control

Table 8: Some Nutritional Parameters of the Feeding Experiment

Groups	Growth	FER	PER	EFC	NPR
1	-0.29±0.06	-0.O5±0.03	-1.12±0.6	-21.03	u-
2	-0.43±0.05	-0.06±0.03	-0.61±0.25	-15.74	0.40
3	0.25±0.06	0.02±0.01	0.18±0.04	44.68	1.09
4 (control)	0.56±0.06	0.04±0.01	0.32±0.08	28.52	1.57

DISCUSSION AND CONCLUSION

The low moisture content would be an advantage in terms of the keeping quality of the seed. The high level of crude protein would make the seed kernel a good source of cheap protein and the high crude lipid would provide enough calories if incorporated into livestock feed.

The evaluation of the seed kernel for its nutritional value is actually an assessment of the availability of its constituent amino acids. Since growth of an animal is related to the amount of essential amino acids assimilated through feed consumption, growth represents a measure of the availability and balance of amino acids in the test diet (Ologhobo, 1987). From the amino acid analysis and comparing with the FAO reference protein, the protein of aduwa seed kernel contains all the essential amino acids, some even higher than the FAO reference protein. This would justify the use of aduwa seed as an alternative source of protein in livestock feed.

Rats fed with either cassava or cassava plus unboiled aduwa seed lost weight and gave negative PER, FER, and EFC while the rats fed on cassava and boiled aduwa seed gained weight with positive PER.

The loss in weight and negative PER observed when rats were fed cassava plus boiled aduwa would mean that the constituent amino acids of the seed protein was not available for assimilation in the raw form and hence the loss in weight observed in the rats. It is also possible that the bitter taste of the seed kernel affected the palatability and this may have prevented feed consumption. We have shown in this study that lesser known legumes and wild trees such as the seed kernel of aduwa is a good source of protein, lipid and minerals which could be incorporated into livestock feeds to replace the common protein sources used in livestock farming.

Since the seed protein has an adequate level of lysine, the moderate deficiency of methionine in the seed protein would however require supplementation. Moreover, the bitter taste in the seed kernel must be removed by boiling at least for 30 minutes before use to enhance palatability.

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