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# The Nutrient Composition of Seeds of the African Pear (*Dacryodes edulis*) and its Implications for Non-Ruminant Nutrition

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**Abstract:** In an investigation conducted to determine the nutrient composition of seeds of the African Pear (*Dacryodes edulis* G. Don, H.J.Lam) and their potential as a feed ingredient in non-ruminant nutrition, samples of sun-dried, ground seeds of the African pear (*Dacryodes Edulis* Seed Meal) (DESM) were analyzed using standard laboratory procedures. The gross energy and metabolizable energy contents of DESM (3820.74 kcal/kg and 3368.04 kcal/kg respectively) and its crude protein (6.98%), ether extracts (8.98%) crude fibre (7.42%) ash (3.36%) and nitrogen-free extracts (73.26%) indicate that DESM can be classified as an energy feed. The anti-nutrients present were tannins (6.37 x $10^{-4}$ mg/100g), phytates (0.49 mg/100 g) and oxalates (1.68 x $10^{-15}$ mg/100 g) while its amino acid profile revealed only trace amounts of the essential and non-essential amino acids and vitamins. DESM contained reasonable amounts of iron, manganese, zinc, sodium and iodine while its calcium, copper and selenium levels were low. It was concluded that DESM may act as a close substitute for maize, especially in poultry diets, on account of its similarity in soluble carbohydrate content to maize and its protein content. This is expected to reduce production costs to poultry farmers in Nigeria and make poultry products available to consumers at more affordable costs.

**Key words:** Seeds, African pear, *Dacryodes edulis*, nutrient composition, non-ruminants

## INTRODUCTION

Maize has, over the years, been a basic ingredient in non-ruminant feeds in Nigeria for providing the energy component of their finished feeds and usually constitutes 50% or more of most commercial poultry feeds (Adebiyi *et al*., 2005, Farinu *et al*., 2005). However, shortfalls in domestic production of maize, high tariffs on its importation, seasonal fluctuations in its availability and its use as an important staple food by Nigeria's human population and as an industrial raw material in the brewery, pharmaceutical and baby foods industries among others have led to an escalation in its domestic price. Since it constitutes over 50% of the finished feeds of most non-ruminants, its continued use invariably increases the costs of production, as feed costs account for up to 80% of production costs and makes the cost poultry products derived therefrom high. If the poultry industry in Nigeria must survive and live up to its responsibility of making poultry meat and eggs available to the populace at affordable prices, the cost of finished poultry feeds in Nigeria must be brought down drastically.

Although some poultry nutritionist have, in the past, explored the possibility of replacing maize partially or wholly with sweet potato, (Fetuga and Oluyemi, 1976), palm oil slurry (Atteh and Ologbenla, 1993), water hyacinth (Dairo, 1997), cassava root meal (Eruvbetine, 2000) and maize offal and cashew nut meal (Oyero *et al*., 2005) among others, most of these new ingredients have the disadvantage of not being readily available, or requiring considerable effort and resources to obtain and process. Some of them are equally useful as human food or industrial raw materials. The seeds of the African pear, *Dacryodes edulis* (G. Don, H.J. Lam) which, according to Leaky (1999), are discarded after the pulp has been consumed by man, are usually available in large quantities during the fruiting season (May to October) in Nigeria. They can be picked up and collected in large quantities at little or no cost. They require little or no further processing, are not consumed by man and are not currently in use as an industrial raw material in Nigeria. Preliminary work on the seed of the African pear by Obasi and Okolie (1993) suggests that it contains as much as 76 g $kg^{-1}$ carbohydrates (other than crude fibre), 126g $kg^{-1}$ of lipids, has no toxic principles and may be high in crude fibre (273 g $kg^{-1}$). So far, no work is available on the potentials of these high-energy seeds of African pear as a feed ingredient for livestock.

The objective of this work was to ascertain the chemical composition of *Dacryodes edulis* seeds with a view to determining their potentials in non-ruminant nutrition.

## MATERIALS AND METHODS

**The experimental site:** The study was carried out at the Poultry Unit of the Teaching and Research Farm, Delta State University, Asaba Campus, Asaba, Nigeria (6° 45' E and latitude and 6° 12' N). Annual rainfall ranges from 1800-3000mm while the maximum day temperatures range from 27.5°C to 30.9°C.

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**Preparation and chemical analysis of the african pear seeds:** Seeds of the African pear, *Dacryodes edulis* (G. Don, H.J. Lam), commonly called 'Ube' in southeast Nigeria, which are usually discarded during the fruiting season, were picked up from Asaba and its environs, washed in water to remove all sand particles and de-hulled by removing the tough leathery coat to expose the cotyledons. The cotyledons were carefully separated by hand and spread out to dry under the sun for several days until a safe moisture level of 10-13% was attained. The dry cotyledons were then winnowed to remove all seed chaff and ground with a hammer mill to obtain the seed meal of *Dacryodes Edulis* (DESM). Samples of DESM were sent to the Institute of Agricultural Research and Training (I A R and T), Ibadan, Nigeria for laboratory analyses to ascertain its proximate composition including its energy content and the presence and quantities of anti-nutritional factors. A portion of the samples was also sent to the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria for determination of its mineral, vitamin and amino acid profiles using AOAC (1990) procedures. Percent oxalates was obtained using the method of Talapatra and Price (1948) by comparing the absorbance of water extracts of DESM samples with standard solutions of oxalic acid using a spectrophotometer set at 420 nm. Percent phytic acid was determined using the method of titration with a standard iron III chloride solution as described by Ler (1983) while % tannic acid was determined by comparing tannin extracts of DESM samples with those of prepared standards using a spectrophotometer at 500nm (Gbedioh *et al*., 1994).

## RESULTS AND DISCUSSION

The proximate, energy and anti-nutrient composition, amino acid profile and mineral and vitamin contents of the test ingredient, *Dacryodes Edulis* Seed Meal (DESM) are presented in Tables 1, 2 and 3 respectively. The gross energy and metabolizable energy contents of the test ingredient (DESM) were 3820.74 kcal/kg and 3368.04 kcal/kg respectively, while its soluble carbohydrate content was over 60%. DESM was low in crude protein (6.98%), contained fairly high amounts of ether extracts (8.98%), crude fibre (7.42%) and ash (3.36%) and had small amounts of tannins ($6.37 \times 10^{-4}$ mg/100 g), phytates (0.49 mg/100 g) and oxalates ($1.68 \times 10^{-15}$ mg/100 g) (Table 1).

The amino acid profile of the test ingredient (Table 2) revealed only trace amounts of the essential and non-essential amino acids. Except for its biotin content (0.1 ppm), only trace amounts of the vitamins assayed were present in the test ingredient (Table 3).

Its Crude Protein (CP) content of 6.98% was much lower than that reported by Obasi and Okolie (1993) (33.8%), and higher than those reported by ICRAF (2001) (3.3%) and Ajayi and Oderinde (2002) (1.4%) for *Dacryodes edulis* seeds, but slightly lower than standards published for yellow maize (8.50-8.90%) by Aduku (1993), NRC (1994) and Olomu (1995). Although the Crude Fibre (CF) content of 7.42% obtained for DESM in this study is quite high, compared to yellow maize whose CF content is about 2.70% (Aduku, 1993), its CF content was considerably lower than values earlier reported for *D. edulis* seeds by Obasi and Okolie (1993) (27.3%) and Ajayi and Oderinde (2002) (48.5%). The fat content of DESM obtained in this study (8.98%) was higher than that of yellow maize (4.10%) (Olomu, 1995) but lower than values reported for *D. edulis* seeds by Obasi and Okolie (1993) and Ajayi and Oderinde (2002) (11.0% and 10.44% respectively). With its soluble carbohydrate (NFE) content of 73.26%, which was close to the 78.50% reported for yellow maize by Olomu (1995), its low crude protein and low crude fibre contents, DESM can safely be classified as an energy feed and used for non-ruminant feeding (Olomu, 1995, Banerjee, 1998). Its ash content of 3.36%, which is higher than values reported for yellow maize by Aduku (1993) and Olomu (1995) is an indication that DESM may be in a position to provide some of the minerals required by non-ruminants. Details of its mineral composition (Table 3) indicated that *Dacryodes edulis* Seed Meal (DESM) contained 0.08% Ca, 0.62% P, 0.39% K and 0.52% Mg. The corresponding values for maize, which are 0.02, 0.28, 0.30 and 0.12% respectively (NRC, 1994), indicate that DESM possesses higher quantities of these macro-nutrients than maize. DESM, however, had only trace amounts of Na, Fe, Mn, Zn, Cu, Se and I as well as the essential amino acids and vitamins (Tables 2 and 3).

Table 1: Proximate, Energy and Anti-nutrient Composition of the Test Ingredient, *Dacryodes edulis* Seed Meal (DESM)

| Fraction/Component | Mean |
|---|---|
| Dry Matter (%) | 89.53 |
| Crude Protein (%) | 6.98 |
| Ether Extract (%) | 8.98 |
| Crude Fibre (%) | 7.42 |
| Ash (%) | 3.36 |
| Nitrogen Free Extract (%) | 73.26 |
| Gross Energy (kcal/kg) | 3820.74 |
| Metabolizable Energy (kcal/kg) | 3368.04 |
| Tannins (mg/100g) | $6.37 \times 10^{-4}$ |
| Phytates (mg/100g) | 0.49 |
| Oxalates (mg/100g) | $1.68 \times 10^{-15}$ |

The presence of small amounts of the anti-nutritional factors, tannins, phytate and oxalates in DESM (Table 1) which, as chelating agents, tend to render some ions, vitamins and proteins unavailable to farm animals (Olomu, 1995) suggests that DESM may have to be subjected to further processing in order to make available to non-ruminant farm animals appreciable amounts of the amino acids, vitamins and minerals

Table 2: Amino Acid Content (ppm) of *Dacryodes edulis* Seed Meal (DESM)

| Amino Acid | Mean±SE |
|---|---|
| **1. Essential Amino Acids** | |
| Phenylalanine | 1.105±0.01 |
| Valine | 0.225±0.19 |
| Thyreonine | 0.085±0.00 |
| Tryptophan | 0.544±0.02 |
| Isoleucine | 0.556±0.05 |
| Methionine | 0.082±0.00 |
| Histidine | 0.095±0.00 |
| Arginine | 0.048±0.00 |
| Leucine | 0.994±0.00 |
| Lysine | 1.087±0.03 |
| **2. Non-Essential Amino Acids** | |
| Cystine | 0.038±0.00 |
| Alanine | 0.050±0.00 |
| Tyrosine | 0.010±0.00 |
| Glycine | 0.089±0.01 |
| Serine | 0.099±0.01 |
| Aspartic Acid | 4.048±0.06 |
| Glutamic Acid | 3.165±0.15 |
| Asparadine | 0.020±0.01 |
| Glutamine | 0.027±0.02 |
| Proline | 0.258±0.05 |

SE = Standard Error; ppm = Parts per million

Table 3: Vitamin and mineral contents of *Dacryodes edulis* Seed Meal (DESM)

| Parameters | Mean±SE |
|---|---|
| **1. Vitamins (ppm)** | |
| A | 0.0035±0.0005 |
| D | 0.0015±0.0005 |
| E | 0.0025±0.0005 |
| K | 0.0020±0.0010 |
| Thiamine ($B_1$) | 0.0065±0.0005 |
| Riboflavin ($B_2$) | 0.0170±0.0010 |
| Pantothenic Acid | 0.0120±0.0010 |
| Niacin ($B_3$) | 0.0790±0.0045 |
| Pyridoxine ($B_6$) | 0.0150±0.0010 |
| Cobalamine ($B_{12}$) | 0.0085±0.0005 |
| Biotin | 0.1000±0.0010 |
| Choline | 0.0025±0.0005 |
| Folic Acid | 0.0020±0.0010 |
| **2. Minerals** | |
| Calcium (%) | 0.08±0.04 |
| Phosphorus (%) | 0.62±0.01 |
| Potassium (%) | 0.39±0.00 |
| Magnesium (%) | 0.52±0.01 |
| Sodium (ppm) | 18.58±0.53 |
| Iron (ppm) | 36.02±0.13 |
| Manganese (ppm) | 16.77±0.26 |
| Zinc (ppm) | 7.16±0.18 |
| Copper (ppm) | 0.78±0.04 |
| Selenium (ppm) | 0.01±0.00 |
| Iodine (ppm) | 0.62±0.01 |

SE = Standard Error; ppm = parts per million

contained in it, or used in conjunction with conventional supplements such as the oil-seed cakes, fish meal and mineral/vitamin premixes to guarantee availability of these nutrients to non-ruminants.

**Conclusion:** The closeness of the energy value of *Dacryodes Edulis* Seed Meal (DESM) to that of maize, and its crude protein content of almost 7% makes DESM a choice replacement for maize in the diets of non-ruminants. This will afford non-ruminant animal farmers, especially poultry farmers, in Nigeria the opportunity to reduce their production costs and make poultry products available to consumers at more affordable prices.

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