

**Full Length Research Paper**

# Nutritional Properties of African Pear Seed and Performance of Defatted Cake in Poultry Feed Formulations

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**Abstract**

The Proximate composition and anti-nutritional properties of the African pear seed (APS) were determined. The oil was extracted and the physico-chemical properties of the oil were analysed. The cake obtained after oil extraction was utilized in poultry feed production and its performance was evaluated. The results showed that the seed has a high dry matter content of 87.22%, as well as a high fat content (19.47%) indicating usefulness in the edible oil processing industry. The oil characteristics were within the required range of values for edible oils. Among the antinutrients analysed, trypsin inhibitors were the highest (7.33%) while polyphenols were lowest (0.35%). The feeding trial revealed that diet 1 with 40:25:15 maize: APS cake: soybean showed no significant difference ( $p \leq 0.05$ ) from the control in most of the parameters tested. All the samples diets sustained growth and no mortality was recorded.

**Key words:** African Pear Seed, Nutritional, Poultry.

**Introduction**

African pear (*Dacryodes edulis*) known as *asube* among the Ibo-speaking people of South-eastern Nigeria is a member of the family *Burseraceae*. It is an evergreen tropical fruit tree which grows in the humid and sub-humid climate of the West African countries. (Kengue, 2001). The African pear (*Dacryodes edulis*) fruit pulp is well known for its richness in protein, fat, fibre, minerals and essential amino acids. They are consumed during the months of April to September. They are often softened by heating in hot water or ash and eaten as an accompaniment to roasted or boiled maize. However, the seeds are not eaten and are often discarded as waste or sometimes consumed by domestic animals if discovered before they are rotten. Previous research (Gunston and Norris, 1982) has revealed that the seed contains 18-34% oil, making it comparable with other oil bearing seeds such as palm kernel (40%), cotton seed oil (30%). However little or no studies have been done on the characterization of the oil, as well as utilization of the cake in feedstuffs.

Investigating the use of nonconventional ingredients in feed production is an easy way of reducing the cost of poultry production since 80% of the cost incurred is from feed purchase. The conventional ingredients (like soybeans) used in animal feeds, are very costly because they are also in high demand for human consumption. The aim of this research therefore is to determine the nutritional and anti-nutritional properties of the African pear seed, determine the physicochemical properties of the oil and the performance of the African pear seed cake in feed formulations.

**Material and Methods**

The proximate composition of the African pear seed sample was determined using methods described by AOAC (1995). The saponins and phenols were determined (AOAC 1995) while the phytates and trypsin inhibitors were determined according to the methods described by Nwosu (2011). The tannins and oxalates were also determined (Pearson 1976).

The oil was extracted using hexane and the acid, iodine and saponification values of the oil were determined as described by Onwuka (2005) while the smoke and flash points were determined using the AOAC (1990) methods. The melting point was also determined (Pike, 2003).

The cake obtained after oil extraction was sundried and used as substitute for soybean cake in feed formulation at different levels. The maize: APS cake: soybean ratios were as follows; 60:0:20 (control), 40:25:15 (Diet 1), 40:27:13 (diet 2), 40:30:10 (diet 3), 60:20:0 (diet 4). The feeds were formulated according to guidelines from Odoloye et al., (2012). As the ratio of soybean cake to African pear cake increased, the other ingredients (maize, wheat bran etc) were adjusted to maintain the minimum protein content (18%) according to the requirement for crude protein in feed formulations as described by NRC (1994).

A total of fifteen (15) four week old broiler birds were distributed into five treatment groups made up of 3 broilers per group. The different groups were fed with the different sample diets for 7 days prior to commencement of the measurements to allow the birds

acclimatize to the environment and the feed. The experimental feeds and water were given ad libitum. The birds were weighed at the beginning of the experiment and on a weekly basis for 4 weeks. The proximate composition of the diets was determined using methods by AOAC (1990). The feed intake, weight gain, protein efficiency ratio and feed conversion ratio were determined as described by Odoloye *et al.*, (2012)

## Results and Discussions

### *Proximate Composition*

The proximate composition is shown on Table 1. The moisture content of the seed was 12.77%, thus giving a dry matter content of 87.22%. This suggests a nutrient dense food material that can actually be utilized in many ways such as in feed supplementation. The protein content (18.03%), carbohydrate (39.10%), crude fibre (3.17%) and ash (3.45%) contents are quite comparable to those of other nuts and oil seeds (Akpambang *et al.*, 2008; Verna and Bandary, 1997). A lipid content of 19.47% shows that the seed can be a good source of oil. The value falls within the range of values for most oil producing seeds like soybeans. (Krogdahl and Bakk-Mckellep, 2002).

### *Anti-nutrients in Africa pear seed*

The most predominant anti-nutrient are the trypsin inhibitors (7.33%) followed by the saponins (1.14%) and the tannins (1.05%). The polyphenols (0.35%), oxalates (0.64%) and phytates (0.77%) were also present in lesser amounts. Saponins are characterized by a bitter taste. They also inhibit nutrient transport and exhibit growth depressing action (Jimoh *et al.*, 2011). Dietary levels of 1% phytate or more have been reported to interfere with mineral availability (Edman, 1990). Chai and Lieman, (2004) has reported that a daily intake of 450 mg oxalate can interfere with body metabolism.

The presence these antinutrients have inhibited the use of the African pear seed as food for humans. However it has been observed in the local communities that they are freely consumed by domestic animals.

### *Pear seed Oil Properties*

The properties of the African pear seed oil are shown on Table 3. The melting point was 32.35°C while the smoke and flash points were 176.13°C and 210.44°C respectively. These characteristics are essential for cooking oil. The iodine value was 48.16ml/g which is comparable with the value for other edible oils (Codex Standard, 1999). The acid value was 7.31mg KOH/g. The value is higher than the recommended value (4.0mgKOH/g) for crude vegetable oils. This may be related to moisture level of the seed, which could induce enzymatic hydrolysis of the oils. However, the peroxide value (14.13meq/kg) falls within the range of values (10-15 meq/kg) recommended in the Codex standard. The saponification value (213.54mgKOH/g) falls within the Codex recommended value (188-265mgKOH/g). Saponification values are highly significant in soap making since it signifies the number of milligrams of potassium hydroxide required to neutralize one gram of the sample during soap making (Bockisch, 1998).

### *Properties of Poultry Feed samples*

The proximate composition of the formulated feed samples is shown on Table 4. The feed samples compared favourably with the control diet in most of the parameters. No significant difference ( $p > 0.05$ ) was observed between the control sample and diet I for the moisture, protein and fat content. Interestingly, all the protein values for the entire sample diets remained above the minimum level (18%) recommended for poultry finisher feeds. (NRC, 1994).

The feed intake (1.77kg/week), weight gain (1.09kg/wk), and protein efficiency ratio (2.87) were highest for the control diet. This was followed by diet 1, 2 and 3 respectively. There was apparent decreases in values as the amount of APS cake increased. However no significant difference ( $p > 0.05$ ) was observed in the weight gain for the control diet and diet 1. The significantly lowest ( $p \leq 0.05$ ) values were recorded for diet 4 with feed intake of 0.66kg/wk, weight gain of 0.22kg/wk and protein efficiency ratio of 1.89. However the mortality rate was zero for all the birds fed on the various diets. All the sample diets were able to sustain growth and steady weight gain for all the birds.

**Table 1.** Proximate Composition of African pears seed

Component	Quantity (%)
Moisture	12.77±0.33
Dry matter	87.22±0.02
Crude Protein	18.03±0.11
Crude fibre	3.45±0.01
Ether Extract	3.17±0.01
Carbohydrates	19.47±0.47
Energy	39.10±0.19

Table 2. Antinutritional factors in African pear seed

Antinutrient	Quantity (%)
Polyphenols	0.35±0.31
Oxalates	0.64±0.01
Phytates	0.77±0.02
Tannins	1.05±0.01
Trypsin Inhibitors	7.33±0.66
Saponins	1.14±0.01

Table 3. Properties of African Pear oil

Physicochemical Parameters	Values
Iodine value (ml/g)	48.16±1.09
Acid Value (mgKOH/g)	7.31±0.39
Saponification value (mgKOH/kg)	213.54±1.63
Peroxide value(meq/kg)	14.13±0.16
Melting Point(°C)	32.35±0.22
Smoke Point (°C)	176.13±0.13
Flash Point(°C)	210.44±0.01

Table 4. Proximate composition and growth performance of formulated diets

Diets	Moisture content %	Crude protein %	Crude fibre %	Ash content %	Ether extract %	Carbohydrate %	Feed intake kg/week	Weight gain kg/week	Protein efficiency ratio(PER)
Control	13.03 <sup>a</sup>	21.74 <sup>a</sup>	4.84 <sup>bc</sup>	3.84 <sup>d</sup>	6.38 <sup>a</sup>	50.16 <sup>ab</sup>	1.77 <sup>a</sup>	1.09 <sup>a</sup>	2.87 <sup>a</sup>
Diet 1	13.53 <sup>a</sup>	21.83 <sup>a</sup>	5.25 <sup>ab</sup>	4.16 <sup>c</sup>	6.09 <sup>a</sup>	49.14 <sup>c</sup>	1.46 <sup>b</sup>	0.78 <sup>a</sup>	2.22 <sup>b</sup>
Diet 2	10.23 <sup>b</sup>	20.29 <sup>b</sup>	4.82 <sup>c</sup>	6.55 <sup>a</sup>	5.59 <sup>a</sup>	52.52 <sup>a</sup>	1.38 <sup>b</sup>	0.65 <sup>b</sup>	2.14 <sup>b</sup>
Diet 3	10.23 <sup>b</sup>	20.23 <sup>bc</sup>	4.68 <sup>c</sup>	6.79 <sup>a</sup>	5.88 <sup>a</sup>	51.68 <sup>ab</sup>	1.42 <sup>b</sup>	0.74 <sup>ab</sup>	2.27 <sup>b</sup>
Diet 4	10.73 <sup>b</sup>	18.39 <sup>c</sup>	5.52 <sup>a</sup>	5.34 <sup>b</sup>	6.14 <sup>a</sup>	53.88 <sup>a</sup>	0.66 <sup>c</sup>	0.22 <sup>c</sup>	1.89 <sup>c</sup>

Means on same column with same superscript are not significantly different ( $p < 0.05$ )

## References

- Akpambang, V.O.C., Amio, I.A. and Izuagu,(2008); Comparative Com position Analysis of two varieties of melon, (*Colocynthiscitrullus* and *cucumeropsis*) and a varieties of almond (*Prunusamygdalus*). *Research Journal of Agric and Biological Sci*, 4:639-642
- AOAC, (1990): *Official Methods of Analysis*. 15th Edition, Association of Official Analytical Chemists. Washington DC
- AOAC, (1995): *Official Methods of Analysis*. 16th Edition, Association of Official Analytical Chemists. Washington DC.
- Bockisch, M. (1998). Fats and oils Campaign. AOCS Press. Pp95-96
- Chai W. and Lieman, M. (2004). Assessment of Oxalate Absorption from from Almonds and black beans with and without the use of extrinsic label. *Jn. Urol.* 172: 953-957
- Erdman, J.W. (1979). Oilseed phytates Nutritional Implication. *Jn. Am. Oil Chem. Soc.* 56:258 264
- Gunston, F. D. and Norris, F. A. (1982): *Lipids in Food Chemistry*, Biochemistry and Technology publications. Robert Max Well. Pp95-139.
- Jimoh, W.A. Fagbenro, O.A. and Adeparusi, E.O. (2011). Effects of Processing on some minerals, antinutrients and nutritional composition of sesame (*Sesamumindicum*)seed meals. *EJEAChe*1858-1864
- (Kengue, J. (2001). *African Pear fruits*. International Center for underutilized crops. Southampton, UK pp15-20
- Krogdahl, A and Bakk-Mckellep, A.M. (2002). *Physiological mechanism in the impairmentof nutrient digestion and transport capacity in salmon intestine*. Soybean Association Hudson Iowa, USA. P128
- Nwosu, J.N. (2011). The effects of processing on the anti-nutritional properties of 'oze'(*Bosqueiaangoleensis*) seed.
- Pearson, D (1976). *Chemical Analysis of Foods*. 7<sup>th</sup> edition. Churchill Livingstone, UK., pp72-73
- Pike, A.O. (2003). *Fat Characterization in Food Analysis* 3<sup>rd</sup> edition. Wurwur Academy publisher, New York pp 221-234
- NRC,(1994). *Nutrient Requirement of poultry*. National Research Council. 8<sup>th</sup> Revision Edition. National Academic press. Washington DC.
- Odoloye E.O.K., Agiente, K and Johnson, V. (2012): Broiler chicks performance on finisher diets containing different levels of reject cashew kernels. *Agricultural Science ResearchJournal*. Vol 2(4). Pp154-156.
- 16 Onwuka, G. I. (2005): *Food Analysis and Instrumentation*. Theory and Practice. First Edition, Naphthali Prints, Lagos.
- 17 Verma S,V.S. and Bandary, M.T. (1997). Rapeseed meal in Poultry Feeding Future prospects. *Poultry Punch* 13(11):27-31