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COMPARATIVE STUDIES OF NUTRITIONAL AND ANTI-NUTRITIONAL PROPERTIES OF AFRICAN BUSH MANGO (IRVINGIA GABONENSIS) AND DATE (PHOENIX DACTYLIFERA) SEEDS

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ABSTRACT

Non-timber forest products have become a vital source of income for rural dwellers, providing local communities with financial benefits and opportunities for sustainable forest management. Phoenix dactylifera, commonly known as dates, belonging to the Family Arecaceae is one of the most abundant fruits in the world. Irvingia gabonensis, known as African bush mango, belongs to the Family Irvingiaceae, is a multipurpose tree species that makes important contributions to nutrition and economic growth. This study evaluates the nutritional and anti-nutritional properties of Irvingia gabonensis and Phoenix dactylifera seeds. Proximate composition was determined using standard method of AOAC, mineral composition was determined using Atomic Absorption Spectrophotometric method while vitamin content and anti-nutrient properties were determined using spectrophotometric method. The carbohydrate content of Irvingia gabonensis and Phoenix dactylifera was 13.38% and 76.93%, Protein content was 9.16% and 6.46% and Fat was 65.53% and 4.56% respectively. The mineral content also revealed that Irvingia gabonensis and Phoenix dactylifera contained 33.36mg and 67.02mg of sodium and 51.13mg and 0.13mg of calcium respectively. The vitamin A content revealed that Irvingia gabonensis and Phoenix dactylifera contained 1.76 mg and 8.15mg while vitamin C was 3.17mg and 1.32mg respectively. The result showed that Irvingia gabonensis and Phoenix dactylifera seeds are rich sources of calcium. The low-fat content observed in Phoenix dactylifera seeds suggests that the seeds could be effectively used for weight loss and could also reduce the risks of heart diseases. However, there is need to create awareness on the nutritional benefits of consuming these seeds to improve human health.

Keywords: Comparative, Nutrient, Anti-Nutrient, Irvingia Gabonensis, Phoenix Dactylifera.

I. INTRODUCTION

Non-timber forest products represent a diverse array of biological resources obtained from forest ecosystems, excluding timber (Sheppard et al., 2020). Non-timber forest products are essential to rural livelihoods in many tropical locations, especially in Africa, where they greatly enhance revenue production, healthcare, and food security (Amusa et al., 2024). Non-timber forest product has become a vital source of income for rural dwellers, providing local communities with financial benefits and opportunities for sustainable forest management. Indigenous tree species like Irvingia gabonensis (African bush mango) and Phoenix dactylifera (date palm) are important but frequently overlooked, serving as sources of nutritional and economic potential among the vast array of non-timber forest products (Nfornkah et al., 2018).Phoenix dactylifera, commonly known as dates, belongs to the family Arecaceae. It is known as Eso Anobi in Yoruba, Nkwuozara in Igbo and

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Dabino in Hausa. It is one of the most abundant fruits in the world; date fruits are widely available in global markets (Krueger, 2021). Date fruit is consumed widely and has been used for traditional medicine purposes for a long time (Mahomoodally et al., 2023). Additionally, the seeds are rich in dietary fiber, which can aid in digestion and help maintain a healthy gut. Phoenix dactylifera seeds contain several minerals including potassium, magnesium, calcium, and phosphorus. Dates are a natural sugar substitute and a great source of energy because of their inherent sweetness, which comes from fructose and glucose (Sayas-Barberá et al., 2023). Date palms offer useful materials in addition to food; their wood is used for building, and their leaves are utilized for basketry and roofing. Irvingia gabonensis, known as African bush mango, is an indigenous fruit tree species that belongs to the Family Irvingiaceae. It is known as Oro in Yoruba, Upupa in Igbo and Biri in Hausa. Seeds of Irvingia gabonensis possess both nutritional and medicinal values, which include antidiabetic, weight loss, antihyperlipidemic and antioxidative effects (Atanu et al., 2022). The edible kernels are used for culinary purposes (Orisa et al., 2024). The seeds, which are frequently ground into "ogbono" powder, are rich in fibre, protein, and good fats. Preliminary research has also shown that they may help control weight and prevent diabetes. Beyond its use in cooking, the tree's fat-rich seeds are becoming more and more well-known abroad for their potential in the production of cosmetics and as a sustainable source of plant-based fats, which will benefit nearby communities economically.

Malnutrition is one major problem faced by many developing countries in the world today; malnutrition has led to high mortality rate thereby causing sicknesses among people most especially the children (Adepoju and Allen, 2019). Despite the usefulness and benefits of these seeds, there’s inadequate knowledge on utilization and lack of comprehensive data on their nutritional profiles which are medicinal to mankind. This gap in knowledge limits their potential applications in the food, pharmaceutical, and nutraceutical industries (Abubakar et al., 2020).

Seeds can serve as alternative or supplementary sources of essential nutrients (Ezeocha et al., 2021). They have significant economic value due to their use in various food products and supplements. Understanding the nutritional profiles of the seeds can improve food security and promote sustainable agricultural practices. Improved knowledge of the nutritional composition can have significant impacts on human health which can improve nutrition and reduce the prevalence of diet-related diseases. Therefore, a need arises for comparative studies to evaluate the nutritional composition of these seeds.

II. MATERIALS AND METHOD

2.1 STUDY SITE

The study was carried out at the Laboratory, Department of Forest Resources and Wildlife Management, Faculty of Agricultural Sciences, Ekiti State University Ado Ekiti, Ekiti State.

2.2 SAMPLE COLLECTION AND PREPARATION

Fruits of Phoenix dactylifera and seeds of Irvingia gabonensis were purchased from a local market (Oja Oba) in Ado Ekiti, Ekiti - State (Figure 1). Phoenix dactylifera seeds were manually removed from the fleshy pericarp. Irvingia gabonensis seeds were properly picked to remove dirt and damaged seeds. The seed were pulverized into powdered form using a mortar and pestle. The powdered samples were well labelled and stored in a

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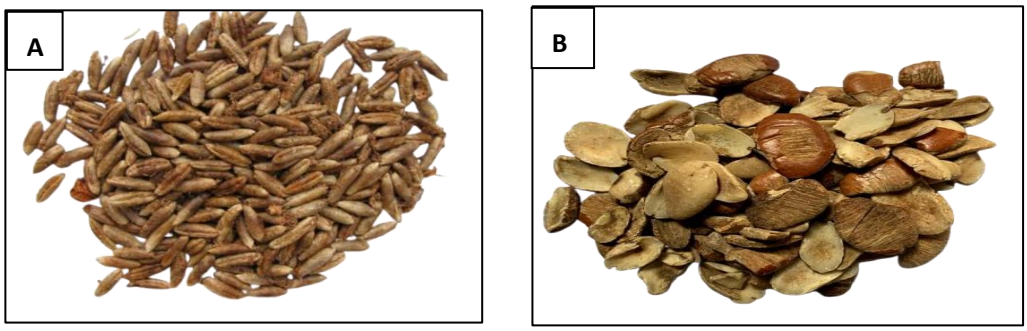

Figure 1. (A) Phoenix dactylifera seeds **(B)** Irvingia gabonensis seeds

2.3 DETERMINATION OF PROXIMATE, MINERALS, VITAMINS CONTENT AND ANTI-NUTRIENTS

Proximate composition (moisture, crude protein, fat, ash, crude fibre and carbohydrate) of the samples were analyzed using standard methods, the carbohydrate content was determined by difference. Vitamin A and C were determined by the filtration method using Whatman filter paper as described by Association of Official Analytical Chemists (AOAC, 2010). Mineral composition (sodium, magnesium, calcium, zinc and iron were determined using Atomic Absorption Spectrophotometer (AAS). Anti-nutrients (tannin, oxalate, phytate and saponin) were determined according to Folin-Denis spectrophotometric method.

2.4 STATISTICAL ANALYSIS

Data obtained from this study was subjected to student's T-test. Means were compared to find the level of significance at P≤ 0.05. Results were expressed in Mean ± Standard Error.

III. RESULTS AND DISCUSSION

The proximate composition of Irvingia gabonensis and Phoenix dactilyfera seeds are presented in Table 3.1. The result showed that Irvingia gabonensis had the higher mean moisture content value of 8.27% while Phoenix dactylifera had 7.43%. The mean fat content value of Irvingia gabonensis (65.53%) was found higher than Phoenix dactylifera (4.56%). The mean protein content of Irvingia gabonensis had the higher value (9.16%) while Phoenix dactylifera had 6.46%. The mean crude fibre content of Phoenix dactylifera had the higher value of 3.87% while Irvingia gabonensis had the lower value (1.73%). The mean ash content of Irvingia gabonensis (2.21%) was found higher than Phoenix dactylifera (0.97%). The mean carbohydrate content of Phoenix dactylifera was found to be 76.93% while Irvingia gabonensis had 13.38%.

Table 3.1: Proximate Composition of Irvingia gabonensis and Phoenix dactilyfera seeds

Parameters (%)	Irvingia gabonensis	Phoenix dactylifera
Moisture	8.27± 0.03	7.43±0.03
Fat	65.53±0.07	4.56±0.24
Protein	9.16±0.04	6.46±0.04
Crude Fibre	1.73±0.05	3.87±0.03
Ash	2.21±0.02	0.97±0.01

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Carbohydrate	13.38±0.03	76.93±0.01

Values are means ± standard error of triplicate determinations. The mineral composition of Irvingia gabonensis and Phoenix dactylifera seeds were presented in Table 3.2. The result showed that Phoenix dactylifera had the higher mean sodium content value of 67.02mg while Irvingia gabonensis had the 33.36mg. The mean iron content value of Irvingia gabonensis was found higher (3.45mg) than Phoenix dactylifera (2.02 mg). The mean magnesium content of Phoenix dactylifera had the higher value of 8.75mg while Irvingia gabonensis had the lower value of 8.22 mg. The mean calcium content of Phoenix dactylifera had the higher value of 62.43mg while Irvingia gabonensis had (51.13 mg). The mean zinc content of Irvingia gabonensis (2.94 mg) was found higher than Phoenix dactylifera (2.62 mg).

Table 3.2: Mineral composition of Irvingia gabonensis and Phoenix dactylifera seeds

Parameters (mg/100g)	Irvingia gabonensis	Phoenix dactylifera
Sodium	33.36±0.45	67.02±0.19
Iron	3.45±0.04	2.02±0.02
Magnesium	8.22±0.01	8.75±0.05
Calcium	51.13±0.13	62.43±0.08
Zinc	2.94±0.03	2.62±0.01

Values are means ± standard error of triplicate determinationsThe vitamin content of Irvingia gabonensis and Phoenix dactylifera seeds were presented in Table 3.3. The mean vitamin A content of Phoenix x dactylifera seeds had the higher value of 8.15mg while Irvingia gabonensis had 1.76mg. The mean vitamin C content of Irvingia gabonensis was found higher (31.79mg) than Phoenix dactylifera seeds (1.32mg).

Table 3.3: Vitamin contents of Irvingia gabonensis and Phoenix dactylifera seeds

Parameters (mg/100g)	**Irvingia gabonensis**	**Phoenix dactylifera**
Vitamin A	1.76±0.04	8.15±0.09
Vitamin B	31.79±0.59	1.32±0.02

Values are means ± standard error of triplicate determinations The anti-nutritional properties of Irvingia gabonensis and Phoenix dactylifera seeds were presented in Table 3.4. The mean phytate content of Phoenix dactylifera had the higher value of 10.55 mg while Irvingia gabonensis had 4.30 mg. The mean oxalate content of Phoenix dactylifera had the higher value (3.81 mg) while Irvingia gabonensis had the lower value (2.15 mg). The mean tannin content of Phoenix dactylifera (56.59 mg) was found higher than Irvingia gabonensis (25.12 mg). The mean saponin content of Irvingia gabonensis had the higher value of 28.17 mg while Phoenix dactylifera had 0.84 mg.

Table 3.4: Anti-nutritional properties of Irvingia gabonensis and Phoenix dactylifera seeds (mg/100g)

Parameters (mg/100g)	**Irvingia gabonensis**	**Phoenix dactylifera**
Phytate	4.30±0.20	10.55±0.30
Oxalate	2.15±0.03	31.81±0.09
Tannin	25.15±1.11	56.59±0.19

Saponin	28.17±0.03	0.84±0.04

Values are means ± standard error of triplicate determinations

IV. DISCUSSION

The results obtained from this study has shown that the proximate, mineral, vitamin and Anti-nutrient properties of Irvingia gabonensis and Phoenix dactylifera were significantly different at $P \leq 0.05$. The moisture content of Irvingia gabonensis was found to be higher than the value obtained by Onojah et al., (2018), who reported a value of 6.28% for moisture content. The low moisture content obtained for both seeds is an indication that they could be stored over a long period without spoilage and not susceptible to microbial growth. (Muhammad et al., 2020).

The fat content result obtained for Irvingia gabonensis agreed to the findings of Onimawo et al, (2003) who reported the value 65.46%. The low-fat content in Phoenix dactylifera is effective for weight loss and can reduce the risks of heart diseases (Chawla et al., 2020). Fat is important in the diet because it aids the absorption of fat-soluble vitamins (Ponnampalan et al., 2024).

The protein content of Phoenix dactylifera was comparable to the result onbtained by Muhammed et al., (2020) who reported a value of 1.59%. The protein values in Irvingia gabonensis and Phoenix dactylifera were found to be relatively low when compared to protein-rich foods like soybeans, cowpeas, pigeon pea, and melon and gourd seeds which range between 23.1 and 33.0% (Olaofe et al., 1994). The recommended daily allowance for children ranges from 23.0-36.0g and for adults 44.56g. Protein is a necessary component of any diet because it fuels the cell to stay active (Muslykhah et al., 2024).

The crude fibre content obtained for Phoenix dactylifera was higher than the value obtained by Muhammad et al., (2020) who reported a value of 2.13%. Diets containing low fibre could cause constipation and eventually lead to colon diseases. Though, crude fibre does not contribute to the nutritive value of foods. Crude fibre aids in digestion, prevents constipation and promotes regular bowel movements (Waseem et al., 2022).

The ash content of Irvingia gabonensis was comparable to the value obtained by Alabi et al., (2024) who reported a value of 2.95%. The low ash content in these seeds indicated that they contain low amount of inorganic minerals. The value obtained revealed that they are not good sources of minerals to meet the recommended daily mineral.

The carbohydrate content of Phoenix dactylifera was lower than the value obtained by Muhammad et al., (2020) who reported a value of 87.61%. This result showed that Phoenix dactylifera is a good source of carbohydrate and is capable of supplying the daily energy need of the body. Carbohydrates are organic compounds that are essential for providing energy, supporting brain function and maintaining overall health (Chandra et al., 2024).

The sodium content of Phoenix dactylifera was comparable to the value obtained by Ayotunde-Ojo and Bankole, (2022) who reported a value of 35.22mg for Dialium guineese. Sodium is an essential mineral, it helps in fluid balance, nerve function, muscle contraction, blood pressure regulation (Antonio et al., 2023).

The iron content of Irvingia gabonensis was lower than the value obtained by Onojah et al., (2018) who reported a value of 36.8mg. Iron is a crucial component of hemoglobin, as it helps in oxygen transport, energy

production and immune function. (Qing Dian et al., 2021)

The magnesium content of Phoenix dactylifera was higher than the value obtained by Adeosun et al., (2016), who reported a value of 0.48mg. Magnesium is an essential mineral in the diet and plays a role in nerve function, bone health and energy production (Barbagallo et al., 2021).

The calcium content of Phoenix dactylifera was found higher than the value obtained by Muhammad et al., (2020) who reported a value of 0.37 mg. Calcium is essential for blood clotting, muscle contraction, maintaining strong teeth and bones (Ramesh, 2022).

The zinc content of Irvingia gabonensis was found lower than the result obtained by Ndatmiso et al., (2012) who reported a value of 11.32mg. Zinc plays a crucial role in the immune system, it helps the body to fight against infections and diseases (Dorota and Baraba, 2019).

The result obtained for vitamin A, corroborated the findings of Muhammad et al., (2020) who reported a value of 8.71mg on Phoenix dactylifera. Vitamin A helps to improve skin health, eye vision and cell growth (Monica and Adrian, 2019).

The result obtained on vitamin C content was found higher than the value obtained by Alabi et al., (2024) who reported 12.45mg on Irvingia gabonensis seeds. Vitamin C is a powerful antioxidant that helps to protect cells from damage. It also facilitates wound healing, collagen production and iron absorption. (Boo, 2022).

The phytate content of Phoenix dactylifera in this study was found higher than Muhammad et al., (2020), who reported a value of 4.82mg. Phytate impairs the body's absorption of iron, zinc, and calcium (Wei and Duoxa, 2023).

The oxalate content of Phoenix dactylifera was lower than the value (8.53) mg reported by Muhammad et al., (2020). Oxalate can act as antioxidants if consumed moderately, it helps to protect the cells from damage caused by free radicals (Jiwang, et al., 2022).

The tannin content of Phoenix dactylifera was lower than the value obtained by Adeosun et al., (2016) who reported 133.20 mg. Tannins have antimicrobial effects, potentially inhibiting the growth of harmful bacteria and pathogens in the digestive system (Ojo, 2022).

The result on saponin content of Irvingia gabonensis was higher than the value of 0.82mg obtained by Alabi et al., (2025). Saponin helps to protect human body against cancers, and also lower cholesterol levels (Elekofehinti et al., 2021).

V. CONCLUSION

The result obtained from this study concludes that the seeds of Irvingia gabonensis and Phoenix dactylifera seeds contained considerable amount of proximate, minerals vitamins and antinutrient properties, each present in varying proportions. Irvingia gabonensis seeds are rich in fat and protein, Phoenix dactylifera seeds are rich in carbohydrate while both seeds are rich in calcium. Phoenix dactylifera seeds are rich in vitamin A, Irvingia gabonensis seeds are rich in vitamin C.

Based on the findings, it may be recommended that Irvingia gabonensis and Phoenix dactylifera seeds should be incorporated into human diet as both seeds serve as excellent sources of calcium which could contribute to the maintenance of strong bones and teeth in human. The low-fat content observed in Phoenix dactylifera

seeds suggests that the seeds could be effectively used for weight loss and could also reduce the risks of heart diseases.

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