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COMPARATIVE STUDIES ON FLAVONOIDS AND PROXIMATE COMPOSITION OF TWO COMMON VEGETABLES EATEN IN EASTERN NIGERIA

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Abstract: The main aim of this study is to compare the nutritional value of the two often consumed vegetables (Gnetum africanum (Ukazi) and Pterocarpus santalinoides (Uturukpa)) in Enugu State, Nigeria. The flavonoids content was determined spectrophotometrically using rutin as the standard. While simple physical and chemical methods were used to assay the proximate composition. The results of the total flavonoid content revealed that G. Africanum is twice richer in total flavonoid (0.783 mg/g) than P. Santalnoides (0.345 mg/g). G. Africanum showed lower moisture content 41% than P. Santalinoides with 54% moisture. Outside moisture content G. Africanum had higher quality content values for ash (14.7% vs. 13.95%), crude protein (15.12% vs. 6.44%), and crude lipid (2.79% vs. 2.20%). The only exception were dietary fiber content, where P. Santalinoides was slightly higher (7.10% vs. G. Africanum's 6.1%) and carbohydrate (9.29 %) than G. Africanum (7.31 %). G. Africanum demonstrated superior nutritional density compared to P. Santalinoides across most measured metrics.

Keyword: G. Africanum (Ukazi), P. Santalnoides (Uturukpa), flavonoids, proximate composition

Introduction

Leafy vegetables are a powerhouse for a variety of vital elements that support general wellbeing and they are key parts of a diet that are both balanced and healthful (Nurzy ´nska-Wierdak, 2025; Kumar, et al., 2020). They are abundant in dietary fibers, vitamins, minerals and antioxidants, all of which are essential for optimum health and preventing a good number of illnesses (Slavin & Lloyd, 2012; Ülger et al., 2018). The importance of leafy vegetables in human nutrition cannot be overstated, as they provide essential nutrients that play vital roles in physiological functions (Aremu et al., 2024; Yadav & Verma, 2024; Thakur et al., 2022). G. Africanum and P. Santalnoides (Plates 1&2) are widely consumed in Eastern Nigeria and are known for their distinct flavors, textures, and culinary versatility.



Plate 1: G. Africanum (Ukazi)

The green leafy vegetable G. Africanum, as seen in plate 1, is cultivated in a subtropical climate. The leaves are firm, have a slightly bitter flavor, and produce seeds that become yellow when matured. G. Africanum are composed of many nutrients and phytochemicals such as calcium, iron, copper, niacin, vitamin C, dietary fiber, and many more and utilized in a variety of traditional dishes. G. Africanum leaves improve good digestion, protect the intestines from dangerous germs, and cleanse the body from oxidative damage (Ali et al., 2011; Onyinyechi et al., 2022; Dada et al., 2021; Okerulu & Onyema, 2015; Macelvi et al., 2023; Johnkennedy, 2024).



Plate 2: Pterocarpus santalinoides (Uturukpa)

P. Santalnoides is a plant genius and a member of the Fabaceae family, which is a class of the Rosidae,. Traditional Nigerian medicine frequently makes use of P. Santalnoides especially in south-eastern Nigeria. The plant has a variety of healthy minerals and compounds. The leaves are rich in magnesium, phosphorus, alkaloids, flavonoids, saponins, and tannins. is frequently used to treat constipation, hemorrhage, and diarrhea; it also lowers inflammation and enhances dental health (Okoye et al., 2010; Aernan et al., 2022; Offor & Ogbugo, 2015; Ayéna et al., 2021; Ahmed et al., 2017; Ogbonna & Idumah, 2018).

P. santalinoides is a species within the Pterocarpus genus and the Fabaceae family. It is commonly called Uturukpa in Igbo, Gbengbe in Yoruba, Gunduru or Gyadar kurmi in Hausa, Kereke in Tiv. Okumeze in Edo, Nja in Efik, Maganchi in Nupe, Atukpa in Idoma, and African rosewood in English.

Among the Igbo people, the leaves are widely consumed as a vegetable in egwsi, groundnut, achi, akparata, etc. soups. The leaves are used in traditional medicine as a remedy for diarrhea and dysentery as antibacterial agents and in treating skin diseases like eczema, candidiasis, and acne, as well as respiratory issues, fevers, and headaches and also possess antispasmodic and digestive properties. The plant is used traditionally to lower inflammation, and its extracts have pain-relieving properties, regulates blood pressure and improve lipid profiles (reduce bad (LDL) cholesterol and increasing good (HDL) cholesterol, used traditionally to manage diabetes (have blood glucose-lowering effects) (Aja et al., 2015; Odeh & Tor-Anyiin, 2014; Nwokorie et al., 2015).

The leaves are rich in various healthy minerals such as Magnesium, phosphorus, calcium, iron, and potassium in significant amounts. P. santalinoides are rich in beneficial phytochemicals such as alkaloids, flavonoids, saponins, tannins, glycosides, and terpenoids (Ogbonna & Idumah, 2018; Umerah et al., 2019). This comparative study was carried out to X-ray the flavonoid content and the proximate composition of the two wide eaten vegetables among the Igbos.

Materials and methods

Sample collection and preparation

The sample leaves of the vegetables were bought from New Market in Enugu State, Nigeria. After separating the plant's edible parts, they were carefully cleaned with running tap water and rinsed with distilled water. The vegetables were dried indoors for three weeks to a constant weight. A blender (Model G K 240, UK) was used to powder the dry samples, which were then kept in a tight plastic container for laboratory analysis.

Total Flavonoids determination

The aluminum-chloride colorimetric method was used to assay for total flavonoids. Rutin was used as a flavonoid standard and to prepare the calibration curve through a serial dilution of 100 mg to obtain 0, 10, 20, 30, 40, and 50 µg/mL. To 1 mL of the standards and the samples extract of (1 g of plant material in 10 milliliters of 95% ethanol for 30 minutes with constant agitation) were added 0.5 miL of 5% $NaNO_2$ and, after 5 minutes, 0.5 mL of 10% $AlCl_3$ and allowed to stand for 5 minutes, then 4 mL of 4% NaOH with vigorous shake and allowed to stand for 15 minutes for colour development. The optical density of the standards and the samples were measured with the spectrophotometer along the with the blank (zero) absorbance at 510 nm (Chandra et al., 2014; Shraim et al., 2021; Tristantini & Amalia, 2019).

Table 1: Standard curve preparation with rutin.

Serial dilution of rutin standard	Absorbance
0	0
0.01	0.007
0.02	0.014
0.03	0.022
0.04	0.03
0.05	0.037
0.06	0.045
0.07	0.054
0.08	0.062
0.09	0.07

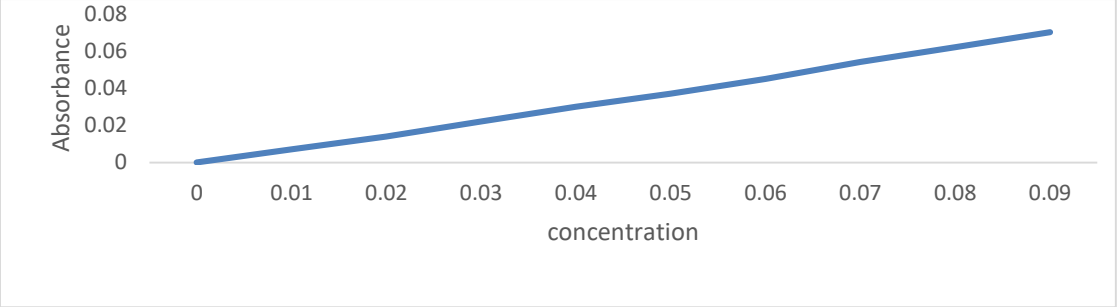


Figure 1: Standard curve for rutin (mg/ml) as reference flavonoids

Proximate composition

The nutritional makeup of the veggies was measured using standard AOAC procedures. A portion was weighed into a petri dish to assess the sample's moisture content, and it was then dried at 105 °C in an oven (Model SAP 2200 Gallen Kamp UK) to a constant weight. The percentage moisture content was used to represent the weight loss. Two grams of the sample were burned in a muffle furnace at 550 °C for two hours until the ash turned white in order to measure the amount of ash present. By leaching 2 g of the sample successively in 1.25% H_2SO_4 (v/v) and 1.25% NaOH (w/v) solutions, the acid-base digestion method was used to determine the fiber content. Using the Kjeldahl method, the protein content was estimated. The evaluated nitrogen was multiplied by 6.25 to determine the total protein. Soxhlet method of extraction for six hours using n-hexane was used to measure the total fat content. Total amount of carbohydrates (g/100g) were estimate by subtracting the total sum of fat, protein, fiber, ash, and moisture from 100. Every analysis was performed in triplicate. The standard deviation was calculated to account for the determination errors. (SD) for both compositions using a standard Microsoft Excel spread sheet (AOAC, 2000).

Results and discussion

The results of the Flavonoids and Proximate composition of the two samples are presented subsequently using tables and figures.

Table 2: Flavonoid and proximate composition of G. africanum (Ukazi) and P. santalinoides (Uturukpa))

Samples (Leaves)	Proximate Composition (%) Parameters						Flavonoid (mg/100g)
	Moisture	Ash	Crude Fiber	Crude Protein	Crude Fat	Total Carbohydrate	
G. Africanum	41±0.36	14.7 ± 0.16	7.10±0.17	15.12±0.11	2.79±0.06	9.29±0.31	78.3±0.06
P. Santalinoides	54±0.37	13.95± 0.31	6.1±0.25	16.44±0.28	2.20±0.43	7.31±0.23	34.5±0.18

Table 2 and Figure 2 shows the results of the flavonoid content and proximate composition of G. africanum and and P. santalinoides. It was observed that G. africanum has twice as much flavonoids (78.3 mg/100g) as P. santalinoides (34.5 mg/100g). This result shows G. africanum is twice better vegetable to protect against cells oxidative damage (antioxidant), reducing inflammation, and protecting against chronic diseases (heart disease, cancer, and diabetes) by regulating blood pressure, cholesterol, and blood sugar, and also supporting brain and immune health than P. santalinoides. The medicinal benefits of flavonoids which probably may include

depending on the type activities as anticancer, antioxidant, anti-inflammatory, antiviral, neuroprotective and cardio-protective, anti-aging and general wellbeing (Ullah et al., 2020; Xiao et al., 2011; Zheng et al., 2025).

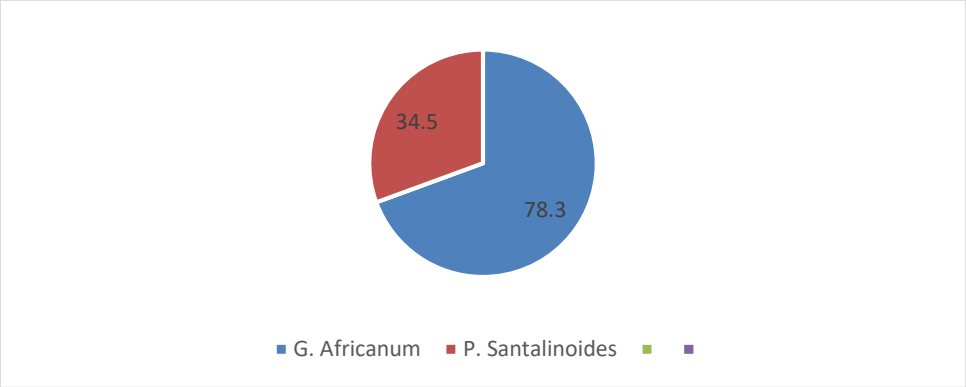


Figure 2: **Total flavonoid composition (**mg/100g**) of G. africanum and P. santalinoides**

The nutritional value (Table 2 and Figure 3) of vegetables is a measure of its high content of protein, fiber, carbohydrates, minerals, vitamins, and antioxidants and it is substantial for health benefits. These components are crucial for maintaining optimal health and prevent chronic diseases such as heart disease, diabetes, and certain cancers (Willett et al., 2006).

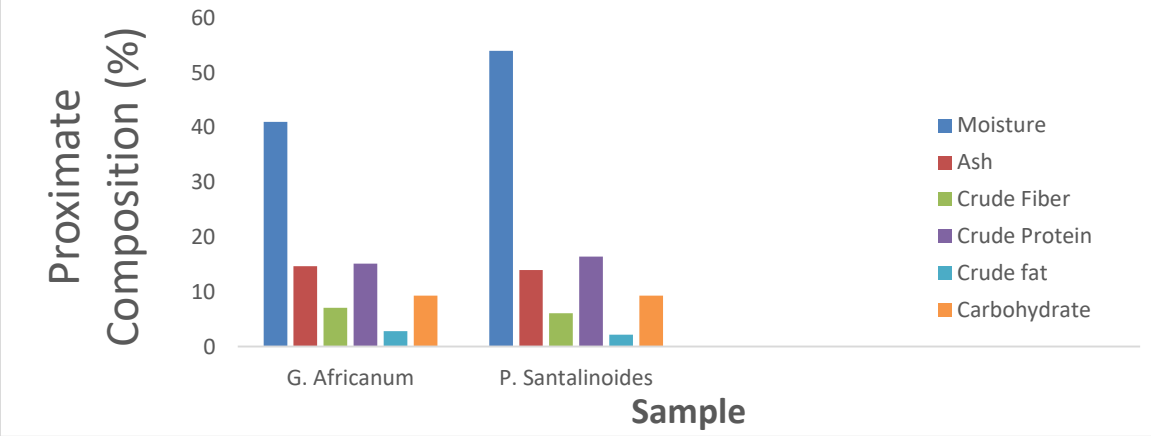


Figure 3: Proximate composition (%) of G. africanum and P. santalinoides

The low moisture content of G. africanum (41±0.36 %) indicates that it will preserve better than P. santalinoides (54±0.37 %) as vegetables with low moisture content is less susceptible to allow the growth of bacteria, yeast, and mold that cause spoilage (Okerulu & Onyema, 2015).

Conclusion

The high composition of ash (minerals), Dietary Fiber, fat, carbohydrate, and flavonoids in G. africanum indicates that it probably possesses anticancer, antioxidant, anti-inflammatory, antiviral, neuroprotective and cardio-protective, anti-aging and general wellbeing than P. santalinoides and the populace should be educated to increase the consumption of G. africanum and other vegetables for overall growth and general wellbeing.

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