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Comparative Analysis of Nutritional and Phytochemical Compositions of Raw and Cooked African Walnut (*Tetracarpidium conophorum)* Seeds

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ABSTRACT

This study was designed to investigate the proximate, mineral and phytochemical constituents of cooked and raw African walnut *(Tetracarpidium conophorum*) seeds. Matured seeds were purchased from a local market in Igbara-Odo, Ekiti State. The seeds were divided into two equal parts; the first part was cooked, while the other was uncooked. Both seeds were shelled, and the fleshy cotyledons were ground into fine powder using mortar and pestle. The result of proximate composition revealed that significant differences exist between the cooked and raw walnuts. The raw walnuts had a higher carbohydrate (51.35%) and Fat (2.20%) content, while cooked samples had higher moisture (35.78%), crude protein (20.59%), Ash (2.66%) and crude fibre content (0.32%). The result of mineral content showed that the raw walnuts had higher zinc (2.27mg/100g) and manganese content (1.31mg/100g), while cooked samples had higher sodium (201 mg/100g), calcium (102mg/100g), iron (18.36mg/100g), copper (36.23mg/100g) and magnesium (54.0mm/100g). Phytochemical screening revealed the presence of flavonoid, phenol and alkaloid in both raw and cooked seeds, while tannin was absent in both raw and cooked seeds. The study revealed that African walnut seeds are rich sources of potassium and calcium. Therefore, African walnuts can be consumed as snacks to supplement essential minerals in the human diet.

Keywords: Comparative, Nutritional, Phytochemical, Mineral, *Tetracarpidium conophorum*

1. Introduction

Plant materials such as roots, stems, leaves, fruit, and seeds provide food, medicine, and other economic uses to man (Olujobi *et al*., 2024). Most importantly, fruits of most tropical trees are good sources of minerals, fibre, protein, fat and vitamins. African walnut (*Tetracarpidium conophorum*) is a climbing shrub native to tropical western and central Africa. It is abundant and widely distributed and consumed by the inhabitants of Africa, mainly Nigeria, Cameroon, the Republic of Congo and the Democratic Republic of Congo. It has a long history as a food plant and is mostly cultivated by peasant farmers for its nuts, which are cooked, consumed as snacks, and sold as a source of income. The importance of African walnuts as an indigenous fruit climber is enormous as they are a multipurpose crop proven to have decorative, medicinal, industrial, and agricultural value over the years (Folake and Risikat, 2023).

Nigeria has a rich diversity of ecological zones, each supporting different types of food crops and forest resources. However, malnutrition is still found in many rural and urban areas. The nutritional quality and quantity of the food consumed by people in rural areas is insufficient when compared to the recommended intake needed for a balanced diet to support healthy growth (F.A.O, 2004). Protein, vitamins, and minerals consumed by rural dwellers are inadequate because they are inaccessible or too expensive to obtain (Olujobi, 2012). Consequently, illness and even death among young children are widespread due to malnutrition (Fan *et al.,* 2022). The use of fruits to provide these nutrients has decreased over the years, and the knowledge of their benefits is vanishing at an alarming rate. Therefore, promoting the consumption of fruits among people is key to improving their health. Also, the need arises to re-orientate people on the sustainable utilization of natural resources, especially fruits, to ensure a balanced diet. The knowledge of the use of indigenous fruits needs to be given more attention and proper documentation; otherwise, when lost, it will be difficult to recover future generations (F.A.O, 2014). The African walnut fruit has the potential to serve as a valuable nutritional source for individuals in rural communities.

Enenwa *et al*., (2020) reported that African walnut fruits are an excellent source of protein, and proteins are good sources of energy and body fuel for daily activities. However, many of these inexpensive fruits have not been thoroughly researched, and their nutritional benefits to the human diet remain largely underutilized. (Ilelaboye *et al.,* 2013). Information on this fruit will be useful for the education of the public as a means to improve their nutritional status. The study was designed to evaluate the nutritional and phytochemical constituents of raw and cooked African walnut fruit found in Ekiti State and to determine its value and suitability in combating food insecurity in our rural communities.

2. Materials and Methods

2.1 Sample Collection and Preparation

Mature African walnut nuts were purchased from the local market in Igbara-Odo, Ekiti State. The fruits were divided into two equal parts; the first part was cooked, while the other was uncooked. Both seeds were shelled, and the fleshy cotyledons were ground into fine powder using mortar and pestle; the samples were labelled and kept in sealable nylons pending use.

2.2 Determination of Proximate, Mineral and Phytochemical Screening

The proximate composition (Moisture, Fat, Fibre, Crude protein, Ash and Carbohydrate) of the samples was determined using standard methods (AOAC, 2010). The mineral content (Calcium, Sodium, Potassium, and Magnesium) was determined by flame photometric method, while iron, zinc, manganese and copper were determined by the atomic absorption spectrophotometric method. Phytochemical screening (Tannin, saponins, phenols, alkaloids, anthraquinones, flavonoids, reducing sugar and cardiac glycosides) were determined according to the method described by AOAC (2010).

2.3 Statistical Analysis

Data obtained from this study were subjected to T-test. Means were compared to determine significant differences at $P < 0.05$. Results were expressed as Mean ± Standard error.

3. Results

The result of the phytochemical screening, as presented in Table 1, revealed that the cooked seeds of *T. conophorum* contained alkaloids, phenol and flavonoids with the absence of saponin, tannin, anthraquinones and cardiac glycosides, while tannin, anthraquinones, cardiac glycosides and reducing sugar were absent in uncooked nut of *T. conophorum* with the presence of saponin, phenol, alkaloid and flavonoid.

The proximate composition of cooked and raw *T. conophorum* seeds, as presented in Table 2, shows a variation in the proximate constituents of both samples. The cooked seeds of *T. conophorum* had a higher moisture content (35.78%) than the uncooked seeds (25.57%). The cooked seeds had a higher protein value (20.59%) than the raw seeds (18.15%). The raw seeds of *T. conophorum* had a higher carbohydrate content (51.35%) than the cooked seeds (39.9%). The fibre content of the cooked seed was (0.32%), and the raw seed was (0.14%), the ash content of the cooked seed was (2.66%) and the raw seed (2.60%). The mineral content of cooked and raw *T. conophorum* seeds, as presented in Table 3, revealed that the cooked seeds of *T. conophorum* had a higher proportion of sodium (20.1mg/100g), calcium (102mg/100g), iron (18.36mg/100g), copper (36.23mg/100g) and magnesium (54.0 mg/100g) contents than raw seeds. The raw seeds of *T. conophorum* had a higher proportion of phosphorus (582 mg/100g), zinc (2.27 mg/100g) and manganese (1.31 mg/100g) contents than cooked seeds.

Table 1: Qualitative phytochemical screening of cooked and raw seeds of *T. conophorum*

Parameters	**Cooked seeds**	**Raw seeds**
Saponins	-	++
Tannins	-	-
Flavonoids	+	+
Phenols	+	++
Alkaloids	++	++
Anthraquinones	-	-
Cardiac glycosides	-	-
Reducing sugar	-	-

Key

- Absent

+ Minute

++ Moderate

Table 2: Proximate composition of cooked and raw seeds of *T. conophorum*

Parameters (%)	Raw seeds	Cooked seeds
Moisture content	25.57±0.34	35.78±0.13
Crude protein	18.15±0.18	20.59±0.10
Fat	2.20±0.06	0.92±0.02
Ash	2.60±0.06	2.66±0.18
Crude fibre	0.14±0.04	0.32±0.02
Total carbohydrate	51.35±0.47	39.90±0.25

Values are Means ± Standard error of triplicate determinations.

Table 3: Mineral composition of cooked and raw seeds of *T. conophorum*

Parameters (mg/100g)	Raw seeds	Cooked seeds
Sodium	17.09±0.09	20.1±0.10
Potassium	582±2.00	501±1.00
Calcium	97.5±0.50	102±1.00
Iron	7.36±0.15	18.36±0.07
Zinc	2.27±0.10	2.21±0.06
Manganese	1.31±0.15	1.02±0.25
Copper	21.57±0.44	36.23±0.13
Magnesium	53.49±0.04	54.0±0.08

Values are Means ± Standard error of triplicate determinations.

4. Discussion

The moisture content of cooked seed (35.78%) was higher than that of raw seed (25.57%); the values were lower compared to the moisture content obtained by Alozie and Ekeh (2020), who reported 62.47% for raw and 63.73% for cooked seeds. Foods with higher moisture content enhance microbial activities (Sobowale *et al.,* 2011). The lower moisture content in raw seeds suggests that raw seeds have higher storage durability than cooked seeds (Udedi *et al.,* 2013). The crude protein content found in the cooked seeds of *T. conophorum* was higher than that of the raw seeds. Both values surpassed 12%, which is the standard for classifying any food as a good source of protein (Onwordi *et al.,* 2009). Protein is essential for body building and tissue repair; this fruit could be a valuable dietary choice for individuals experiencing protein deficiency. The carbohydrate content of the raw seeds was found to be 51.35%; this assertion corroborates the findings of Ayotunde-Ojo and Bankole (2022), who reported 51.35% for *Chrysopyllum delevoyi.* The carbohydrate content of raw seeds was higher than that of cooked seeds. The higher carbohydrate value obtained in raw seeds suggests that they could be a good source of energy and body fuel for daily activities. Crude fibre contents for both raw and cooked seeds of *T. conophorum* were 0.14% and 0.32%, respectively. The values obtained in this study were lower than the values obtained by Ojokoh *et al*., (2020), who reported 5.02% for raw seeds and 5.16% for cooked seeds. The low crude fibre obtained from this study indicates that walnut fruit may not be a good source of dietary fibre in human nutrition. Nweze *et al.* (2021) reported that dietary fibre intake helps to lower the serum cholesterol and risk of coronary diseases and breast cancer.

The mineral content revealed that raw seeds of *T. conophorum* are rich in sodium, calcium, iron, copper, and magnesium, while cooked seeds are rich sources of manganese, zinc and potassium. The value reported for potassium was extremely high, followed by calcium in *T. conophorum* seeds.

Minerals are very important for normal body function. Sodium is important in maintaining the body's acid-base balance. Calcium is essential for bone and teeth formation. Magnesium is an important element in connection with circulatory diseases (Rosique-Esteban *et al.,* 2018). Iron is essential for blood formation and the normal functioning of the central nervous system (Kulaszyńska *et al.,* 2024). Potassium, magnesium and calcium play important roles in health and nutrition, while calcium and phosphorous are essential in bone metabolism. It is important to note that the absorption of iron and copper is responsible for cellular defence and protection of the mucous membrane, anti-anemic and formation of haemoglobin (Onawumi *et al.,* 2013).

The phytochemical screening revealed the presence of saponin, phenol and alkaloids in moderate amounts in both raw and cooked seeds, while alkaloids are also present in moderate amounts in cooked seeds. Phenol was present in minute amounts in the raw nut, while flavonoid and phenol were also in minute amounts in the cooked seeds. Phytochemicals are biologically active compounds found in minute amounts; they are not exactly nutrients, but they are important as they protect against degenerative diseases (Chikezie and Yvonne, 2018). Flavonoids have protective effects such as anti-inflammatory, anti-viral, anti-carcinogenic and antioxidant properties. Alkaloids are effective plant substances used as analgesic, antimicrobial, and bacterial properties (Kurek, 2019). They are believed to cure asthma (not acute asthma) and constipation in elders. The presence of saponin indicates that walnuts have cytotoxic effects and are related to the sex hormone (oxytocin), which is responsible for milk release (Ojobor *et al.,* 2018).

5. Conclusion

This study was designed to evaluate the nutritional composition of raw and cooked African walnut fruit. The result obtained has indicated that there is a substantial quantity of proximate constituents (moisture, ash, fat, crude fibre, protein and carbohydrate) in both cooked and raw seeds of *T. conophorum*, phytonutrients (saponins, tannins, flavonoids, phenols and alkaloids) and minerals (sodium, potassium, calcium, magnesium, iron, zinc copper) were found in varying proportions. However, the result has shown that *T. conophorum* fruit is rich in calcium, potassium and magnesium containing a higher nutritional value in carbohydrates and protein.

6. Recommendation

This research showed that cooked and raw seeds of *Tetracarpidium conophorum* provide essential minerals which are good sources of calcium, potassium and magnesium. However, a need arises to create more awareness on the nutritional benefits of consuming *T. conophorum* as snacks to supplement essential minerals in the human diet. Based on this study, it is recommended to explore the pharmaceutical potential of both raw and cooked *T. conophorum* seeds, as they contain bioactive compounds like flavonoids, phenol, and alkaloids.

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