A Comprehensive Study of Nutrients and Anti-Nutrients Constituents of *Landolphia Owariensis* Fruit

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Abstract
A comprehensive analysis of Landolphia owariensis fruit using standard methods examined both its nutritional composition and anti-nutritional factors. Nutritionally, the fruit contains low levels of protein (0.55%) and fat (0.66%), and its crude fiber (1.20%) which contributes modestly to dietary needs. The carbohydrate content was measured at 15.64%, offering approximately 70.70 kcal per serving, which positions the fruit as a moderate energy source while maintaining a relatively low caloric count. The ash content of 1.57% suggests the presence of minerals, albeit in moderate quantities, underscoring the fruit's overall nutritional profile. Key minerals identified in every 100 grams include Ca(19.00mg), Na(5.30mg), K(320.11mg), P(15.45mg), and Fe(1.52mg). The vitamins content showed the presence of vitamin A, B-vitamins and C. However, the analysis indicated several anti-nutritional components such as tannins (10.52 mg/100g), phytates (8.10 mg/100g), oxalates (6.56 mg/100g), and saponins (4.51 mg/100g). While these compounds may pose some limitations on nutrient absorption, they are generally present in safe concentrations that could even offer health benefits like antioxidant and anti-inflammatory properties. The findings suggest that the fruit could be incorporated into a balanced diet, given its favorable nutritional composition alongside its relatively low anti-nutritional factors.

Keywords: *Landolphia Owariensis fruit, nutrients, anti-nutrients*

Introduction

Landolphia owariensis, commonly known as the African rubber vine (English), Esoor akitipa (Igbo), mba (Yoruba), Ciwo (Hausa), Mwaghalak (Mwaghavul) and Maklak (Ngas). The plant is native to West and Central Africa and its fruit is not only interesting but also plays a significant role in the local ecology and economy.

The fruit of *Landolphia owariensis* is a berry-like structure that can vary in size, often showcasing a bright yellow or orange hue when ripe. These fruits are edible and are consumed by various animals, including birds and mammals, which aid in the dispersal of seeds throughout their habitat.

Nutritionally, the fruit may be rich in vitamins and other nutrients, making it a valuable addition to the diet of local communities. It is often collected for consumption and used in traditional dishes or processed into jams and juices. Moreover, the latex produced from the plant has historically been used to make rubber, contributing to its economic importance.

Landolphia owariensis, a tropical climbing plant recognized for its consumable fruits, has attracted growing interest lately owing to its nutritional potential and customary applications. However, there is a deficiency in scientific literature on this species, prompting the need for an extensive investigation. This study delves into factors such as proximate composition,

nutritional and anti-nutritional elements, offering crucial insights for scholars, nutrition experts, and food scientists.

Materials and Methods

Samples of fresh *Landolphia owariensis* fruit were obtained from bushy areas of Pushit in Mangu LGA of Plateau state, Nigeria. The paste of the fruit samples was prepared from well washed fruit with tap water in order to remove any dirt or adhering particles. Each fruit was peeled off to remove the bark and the seeds removed. The flesh was then crushed using food blender to get a fine pulp or paste.

All chemicals used are of analytical grade purchased from E. Merck (Germany).

Proximate Analysis

The moisture, ash, crude fiber, fat and crude protein were determined as described by Onwuka (2018).

Determination of moisture content

Ten grams (10 g) of the sample was put into a previously weighed moisture can (W1). The sample in the can (W2) was dried in the oven at 105°C for 3 h. It was cooled in desiccators and weighed.

It was returned to the oven for further drying after which it was left to cool and weighed repeatedly at an hour interval until a constant weight was obtained (W3). The final dry weight was recorded and used to calculate the percentage moisture content of the sample as shown below:

% Moisture content = (W2−W3/ W2−W1) x100

Where W1 = initial weight of empty can

W2 = weight of can + sample before drying

W3 = weight of can + sample after drying

Determination of crude protein content

The total N_2 was determined and multiplied with factor 6.25 to obtain the protein content. One gram of processed sample was mixed with 10 mL of concentrated H_2SO_4 in a digestion flask. A tablet of selenium catalyst was added to it before it was heated in a fume cupboard until a clear solution was obtained (i.e. the digest) which was diluted to 100 mL in a volumetric flask. 10 mL of the digest was mixed with equal volume of 45 % NaOH solution in a Kjeldahl distillation apparatus. The mixture was diluted into 10 mL of 4 % buric acid containing 3 drops of mixed indicator (bromoscresssol green/methyl red). A total of 50 mL of distillates was collected and titrated against 0.02M EDTA from green to deep red end point. The N_2 content and hence the protein content was calculated using the formula below:

% Protein = % N_2 x 6.25

% N_2 = (100/W) x (N x14/1000) x (Vt /Va) x TBK

Where: w = weight of sample, N= Normality of titrant (0.02 H_2SO_4), Vt = total digest volume (100 m/s), Va = volume of digest analyzed (10 mL), T = titre value of sample, B = titre value of blank

Determination of ash

Three grams of the sample was added to a weighed (W1) dried porcelain crucible (W2) and ignited in the muffle furnace at 550°C. The sample was allowed to ash to a grayish white ash, brought out from the furnace using a forcep and left in a desiccator to cool (W3). The ash was weighed and calculated as percentage ash as shown below:

% Ash = (W_3−$W_{1/}$ W2−W1) x100

Where: W1 = weight of empty crucible, W2 = weight of crucible + food before drying or ashing W3= weight of crucible + ash

Determination of fat content

Three grams (3 g) of the sample was weighed into a thimble 300 mL weighed round bottom flask and reflux flask. The round bottom flask was filled with about 250 mL of petroleum ether and placed on a heating mantle and set at 60°C and allowed the ether to boil, the vapour rises, condense into the thimble on the reflux flask. This continues until all the oil in the sample is washed off showing no traces of the oil in the reflux flask. The thimble containing the sample was removed from the flask and the excess ether recovered, leaving the oil on the round bottom flask. The flask was detached from the set up and placed on the oven set at 105°C to dry off excess after which it was allowed to cool in a desiccator and the weight of the oil was calculated as shown below:

% Fat = (Weight of fat/Weight of sample) x 100

Determination of crude fiber

Two (2 g) grams of each sample were digested with 200 mL of 1.25 % H_2SO_4 solution under reflux for 30 min boiling. The digest was allowed to cool and then filtered with Buckner funnel equipped with muslin cloth. The residue was washed thrice with hot water, scooped into a conical flask and digested with 200 mL of 1.25 % NaOH solution under reflux for 30 min boiling. The digest was cooled, filtered and washed thrice with distilled water. The residue was drained and scooped into a previously dried and weighed crucible and then put into the oven to dry at 105°C to a constant mass. The dish with its content was reweighed after drying and then placed in the muffle furnace to ash at temperature of 550°C for 3 h. The ash was withdrawn at the end and put in a bell jar and reweighed. The weight of fibre was calculated as a percentage of weight of sample analysed. It was given by the expression below:

% Crude fibre = (W2−W3/Weight of sample) x 100

Where: W2= weight of crucible + sample after boiling, washing and drying, W3= weight of crucible + sample as ash

Determination of carbohydrate

The carbohydrate content of the sample was determined by estimation using the arithmetic difference method described by Onwuka (2018). The carbohydrate was calculated and expressed as the Nitrogen free extract (NFE) as shown below:

% CHO= % NFE = 100 - % (a+b+c+d+e)

a= protein content b= fat content c= ash content d= crude fibre content e= moisture content

Determination of caloric value

The caloric value was estimated using Atwater factors as described by Onwuka (2018). The caloric value was calculated by multiplying the proportion of protein, fat and carbohydrate by their respective physiological fuel value of 4, 9, and 4 kcal/g respectively and taking the sum of their products.

The caloric value was calculated thus:

F_e = (% CP x 4) + (% CF x 9) + (% CHO x 4)

Where: F_e = Food energy (in grain calories), CP= Crude protein, CF= Crude fat, CHO= Carbohydrate

Determination of Anti-nutritional Factors

Tannin

The method described by Nwosu (2011) was used to determine the tannin content of the sample.

Exactly one gram of each sample was weighed into a centrifuge tube with 2 mL of distilled water. It was centrifuged at 1500 rpm for 10 min. The centrifuge samples were then poured out into a beaker and the supernatant (extract) dispersed. One mL of $NaCO_3$ and Folin Denis reagent was added in the beaker and allowed to settle. Therefore, the readings were taken using a spectrophotometer. Tannin was calculated as follows:

% Tannin =An/As x C x 100/W x Vf/Va

Where: An= absorbance of test sample, As = absorbance of standard sample, C = concentration of standard solution, Vf = Total volume of extract, Va = volume of extract analyzed, W = Weight of sample

Phytate

The method described by AOAC (2012) was used to determine the tannin content of the sample.

One gram of the sample was extracted in duplicate for 4 h with 20 mL of 0.1M nitric acid with constant agitation. The tubes were stoppered and placed in a boiling water bath for 20 min and allowed to cool. About 5.0 mL of amyl alcohol was added to each tube followed by 1.0 mL of ammonium thiocyanate (100g/l). The tubes were shaken thoroughly and centrifuged at 2000 rpm and then absorbance of the amyl alcohol layer was determined at 465 nm against amyl alcohol exactly 15 min after the addition of the ammonium thiocyanate using spectrophotometer. One milliliter of the extract was pipetted into a test tube fitted with a ground glass stopper together with 1 mL of ferric solution. Ferric solution was prepared by dissolving 0.2 g hydrated ammonium iron (III) sulphate in 100 mL of 2M HCl and made up to 1000 mL with diluted water and the absorbance was measured at 519 nm against distilled water using spectrophotometer. A standard solution was also prepared for the analysis. Percentage phytic acid was then calculated using the absorbance of the test sample and that of the standard solution.

Oxalate

The oxalate content of composite flour was determined using the method of Iwuoha and Kalu (2014). Determination of oxalate involves the following three steps: digestion, oxalate precipitation and permanganate titration.

Digestion

At this step about 2 g of the samples was suspended in 190 mL of distilled water contained in 250 mL conical (Erlenmeyer) flask; 10 mL of 6 M HCl was added and the suspension was then digested at 100 °C for 1 h, this was followed by cooling, and then solution was made up to 250 mL before filtration using distilled water.

Oxalate precipitation

Duplicate portions of 125 mL of the filtrate were measured into a beaker and four drops of methyl red indicator was added, followed by the addition of concentrated NH_4OH solution (drop wise) until the test solution changed from its salmon pink colour to a faint yellow colour (pH 4 to 4.5).

Each portion was then heated to 90 °C, cooled and filtered to remove precipitate containing ferrous ion. The filtrate was again heated to 90 °C and 10 mL of 5 % $CaCl_2$, solution was added while being stirred constantly. After heating, it was cooled and left overnight at 5°C. The solution was then centrifuged at a speed of 2500 rev/min for 5 min. The supernatant was decanted and the precipitate completely dissolved in 10 mL of 20 % (v/v) H_2SO_4 solution.

Permanganate titration

At this point, the total filtrate resulting from digestion of 2 g of sample was made up to 300 mL.

Aliquots of 125 mL of the filtrate were heated until near-boiling, and then titrated against 0.05 M standardized $KMnO_4$ solution to a faint pink color which persisted for 30 sec. The calcium oxalate content was calculated using the formula:

T x (Vme)(DF) x 105/(ME) x mf

Where: T is the titre of $KMnO_4$, (mL). Vme is the volume-mass equivalent in which 1 cm^3 of 0.05 M$KMnO_4$ solution is equivalent to 0.00225 g anhydrous oxalic acid). DF is the dilution factor VTA (2.4, where VT is the total volume of filtrate (300 mL) and A is the aliquot used (125 mL). ME is the molar equivalent of $KMnO_4$ in oxalate ($KMnO_4$ redox reaction and mf is the mass of sample used.

Saponin

Saponin was determined using the colorimetric method (AOAC, 2012). The sample (0.5 g) was weighed and put into a test tube followed by the addition of 10 mL of distilled water. The mixture was shaken and allowed to stand for 1 h. The formation of stable foaming froth was observed.

About 1 mL of the mixture was pipetted into another test tube with about 5 mL of distilled water added to the extract. This was followed by addition of a drop of olive oil. The test tube with its content was shaken and it became cloudy. The absorbance was measured at 620 nm using spectrophotometer. The quantity of saponin contained in each sample was estimated from the standard saponin curve obtained from plotting the concentration of the standard concentration against the absorbance. Hence, amount of saponin calculated as:

PS = Ab x S x DF x 100 (mg g^{-1} saponin)

Where PS = Percentage of saponin, Ab = Absorbance, S = Slope, DF = Dilution factor

Vitamin Analysis

Determination of pro-vitamin A

The spectrophotometric method described by Onwuka (2018) was employed in the determination of pro-vitamin A. Five grams (5 g) of the samples was dissolved in 30 mL of absolute alcohol (ethanol) and 3 mL of 5 % Potassium hydroxide was added to it. The mixture was boiled under reflux for 30 min and was cooled rapidly with running water and filtered. Thirty milliliters (30 mL) of distilled water was added and the mixture was transferred into a separating funnel. Three (3) portions of 50 mL of the ether were used to wash the mixture, the lower layer was discarded and the upper layer was washed with 50 mL of distilled water. The extract was evaporated to dryness and dissolved in 10 mL of Isoprophyl alcohol and its absorbance was measured at 325 nm.

Pro-vitamin A content of the samples was then calculated as follows:

Pro-vitamin A (µg/100g) = (100/w× au/as) × c

Where: au = absorbance of test sample, as = absorbance of standard solution, c = concentration of the test sample, w = weight of sample

Determination of vitamin B1 (thiamin)

Five (5) grams of sample was homogenized with 50 mL of ethanol sodium hydroxide. It was filtered into 100 mL flask; 10 mL of the filtrate was pipetted, and colour was developed by the addition of 10 mL potassium dichromate before reading at 430 nm wavelength in a spectrometer.

A standard thiamin solution was prepared and diluted. Ten (10) mL of solution was analyzed. The readings were made with the reagent blank at Zero (Onwuka, 2018). The formula below was used to calculate thiamin:

Thiamin (mg/100g) = (100/W) x (Au/As) x C x (Vf/Va) x D

Where: W = Weight of sample analyzed, Au = Absorbance of test sample, As = Absorbance of standard solution, Vf = Total volume of filtrate, Va = Volume of filtrate analyzed, D = Dilution factor where applicable, C = Concentration of the standard.

Determination of vitamin B2 (Riboflavin)

The method of Onwuka (2018) was used to determine the riboflavin content of the sample. Five (5) grams of each sample was extracted with 100 mL of 50 % ethanol solution, shaken for 1h and was filtered. Ten milliliters potion was treated with equal volume of 5 % potassium permanganate ($KMnO_4$) solution and 10 mL of 30 % hydrogen peroxide (H_2O_2). The mixture was allowed to stand on a water bath for 30 min, after which 2 mL of sodium sulfate (Na_2SO_4) solution was added.

It was diluted to 50 mL with distilled water prior to measuring in spectrophotometer at 510 nm wavelength. The reading was taken with the reagent blank at zero. The formula below was used to calculate riboflavin:

Riboflavin (mg/100g) = (100/W) x (Au/As) x C x (Vf/Va) x D

Where: W = weight of sample analyzed, Au = Absorbance of the test sample, As = Absorbance of standard solution, Vf = Total volume of filtrate, Va = volume of filtrate analyzed, C = Concentration of the standard, D = Dilution factor where applicable.

Determination of vitamin B3 (Niacin)

Five (5) grams of the sample was added to 50 mL of ammonium sulfate $(NH_4)_2SO_4$ and shaken for 30 min. Three drops of ammonia solution was added to the sample and filtered into a 50 mL volumetric flask prior to adding 5 mL of potassium ferrocyanide. This was acidified with 5 mL of 0.02M sulphuric acid and absorbance was measured in the spectrometer at 470 nm wavelength. A standard niacin solution was prepared and diluted. Ten (10) mL of the solution was analyzed as discussed above. The reading was made with reagent blank at zero. The formula below was used to calculate niacin as stated by Onwuka (2018):

Niacin (mg/100g) = (100/W) x (Au/As) x C x (Vf/Va) x D

Where W = weight of sample analyzed, Au =Absorbance of the test sample, As = Absorbance of the standard solution, Vf = Total volume of filtrate, Va = Volume of filtrate analyzed C = Concentration of the standard, D = Dilution factor where applicable.

Determination of vitamin C (Ascorbic acid)

The method used was as described by Okwu and Josiah (2006). Ten (10) grams of the sample was extracted with 50 mL ethylenediaminetetraacetic acid (EDTA) solution for 1h and filtered through a whatmann filter paper into a 50 mL volumetric flask. This was made up to the mark with the extracting solution. Twenty (20) mL of the extract was pipetted into a 250 mL conical flask and 10 mL of 30 % potassium iodide (KI) was added and also 50 mL of distilled water added. This was followed by 2 mL of 1 % starch indicator. This was titrated against 0.01 M copper sulfate ($CuSO_4$) solution to a dark end point.

Vitamin C (mg/100g) = 0.88 x (100/5) x (Vf/20) x T

Where: Vf = Volume of the extract T = Sample titre - blank titre

Determination of tocopherol

Method described by Achikanu *et al*. (2013) was used in determination of tocopherol. One gram of the samples was mixed with 20 mL of n-hexane in a test tube for 10 minutes and centrifuged for 10 minutes. The solution was filtered; 3 mL of the filtrate was transferred into a dry test tube in duplicates and evaporated to dryness in a boiling water bath. Following this, 2 mL of 0.5M alcoholic potassium hydroxide was added and boiled for 30 minutes in a water bath. Then 3 mL of n-hexane was added and was shaken vigorously. The n-hexane was transferred into another set of test tubes and evaporated to dryness. Two milliliters of ethanol was added to the residue. A milliliter of 0.2 % ferric chloride in ethanol was added. Then 1 mL of 0.5 % α1 α1-dipyridyl in ethanol was added followed by the addition of 1 mL of ethanol to make it up to 5 mL. The solution was mixed and absorbance taken at 520 nm against the blank to obtain tocopherol content.

Results and Discussion

Table 1: Proximate Composition

Component	%
MC	80.38±0.03
CP	0.55±0.02
Fat	0.66±0.01
CF	1.20±0.01
Ash	1.57±0.01
CHO	15.64±0.02
Kcal EV	70.70±0.09

Table 2: Anti-Nutrient Content (mg/100g)

Anti-Nutrient	Quantity mg/100g)
Tannin	10.52±0.02
Phytata	8.10±0.01
Oxalate	6.56±0.02
Saponn	4.51±0.02

Table 3: Mineral Composition (mg/100g)

Mineral	Quantity (mg/100g)
Ca	19.00±0.02
Na	5.30±0.01
K	320.11±0.03
P	15.45±0.02
Fe	1.52±0.02

Table 4: Vitamins Composition

Vitamin	Quantity (mg/100g)
A	24.82±0.02
Thiamin(B1)	0.05±0.34
Riboflavin(B2)	0.04±0.02
Niacin (B3)	3.90±0.02
C	54.00±0.03

Table 5: Anti-Oxidants Properties

Anti-Oxidant	
Vitamin C (mg/100g)	45.70±0.05
Vitamin E (mg/100g)	2.28±0.01
Carotenoid (mg/100g)	0.90±0.03
Total Phenolic Content (mgGAE/100g)	250.60±0.02

Proximate Composition

The proximate analysis of *Landolphia owariensis* fruit reveals significant insights into its macronutrient profile. While specific numerical values for proteins, carbohydrates, and fats are crucial, it is essential to understand that the balance of these components contributes to the overall health benefits of the fruit.

The proximate analysis of *Landolphia owariensis* reveals interesting nutritional characteristics. The fruit demonstrates a notably high moisture content (MC) of 80.38%, which contributes to

its succulent nature and refreshing taste. This high moisture content also suggests that the fruit could be beneficial for hydration in tropical climates where it naturally grows.

The carbohydrate content (CHO) stands at 15.64%, making it a moderate source of energy with (EV) 70.70 kcal per serving. This composition indicates that the fruit could serve as a reasonable energy source while being relatively low in calories, potentially beneficial for those monitoring their caloric intake. Its carbohydrate content, primarily from simple sugars, makes it a quick source of energy, which can be particularly beneficial in regions where food security is a concern.

The protein content (CP) (0.55%) and fat content (Fat) (0.66%) are relatively low, which is typical for most fruits (Morais *et al*., 2017). The crude fiber (CF) content of 1.20% suggests that the fruit can contribute to dietary fiber intake, albeit modestly. The ash content (Ash) of 1.57% indicates the presence of various minerals, though in moderate amounts.

Anti-Nutrients Factors Present

Understanding the anti-nutrient composition is crucial as these compounds can affect nutrient absorption and utilization. The analysis revealed several anti-nutrient factors in *Landolphia owariensis* fruit.

Tannins showed the highest concentration at 10.52 mg/100g. While tannins can contribute to astringency and potentially interfere with protein digestion, they also possess beneficial antioxidant properties when present in moderate amounts. They are particularly beneficial for cardiovascular health by inhibiting the oxidation of low-density lipoproteins (LDLs), commonly referred to as "bad" cholesterol, thereby reducing the risk of atherosclerosis. Furthermore, tannins may enhance cardiovascular function by lowering blood pressure, reducing LDL cholesterol levels, and improving vascular health (Afia, 2020). However, the excessive intake of tannins may inhibit iron absorption, potentially posing a risk to individuals with iron deficiency (Machmud, Djuwita Hatma & Syafiq, 2019).

Phytates, present at 8.10 mg/100g, are known to bind with minerals like calcium, iron and zinc, potentially affecting their bioavailability. The compound and other plant-based constituents may synergistically form insoluble complexes affecting bioavailability of these essential elements (Zhang *et al*., 2022). However, the levels found in *Landolphia owariensis* are relatively moderate compared to many other fruits and vegetables.

Oxalates (6.56 mg/100g) and saponins (4.51 mg/100g) were found in lower concentrations. While oxalates can interfere with calcium absorption which can increase the risk of kidney stone formation as well as mineral deficiency (Huynh, Nguyen and Nguyen, 2022), saponins might affect nutrient uptake. The levels present in this fruit are generally considered safe for most consumers.

Mineral Composition: A Wealth of Nutrients

Minerals play a fundamental role in human health, and *Landolphia owariensis* fruit is a treasure trove of essential minerals. According to the data presented in Table 3, which outlines the mineral composition per 100g of the fruit, the impressive potassium content stands out; it is vital for several body functions, including muscle contraction and nerve signaling. Additionally, iron is critical for the production of hemoglobin, and calcium is essential for bone health. The trace amounts of sodium showcase the fruit's potential as a low-sodium snack, making it a heart-healthy option. Phosphorus works closely with calcium to build bones and teeth and is involved in energy production. While the phosphorus content in this fruit may not be particularly high, every little bit adds up when incorporated into a diverse diet.

Vitamins: Nature's Powerhouse

Vitamins are indispensable for maintaining optimal health, and the vitamin profile of *Landolphia owariensis* fruit reflects its potential as a dietary supplement. As depicted in Table 4, Vitamin C, in particular, is abundant in this fruit, making it an excellent choice for boosting immune function and skin health. Its antioxidant properties help mitigate oxidative stress, further enhancing overall well-being (Otocka-Kmiecik and Król, 2020). Additionally, the presence of B-vitamins supports energy metabolism (Gonçalves and Portari, 2021), making it beneficial for those seeking sustained energy levels throughout the day. Vitamin A is vital for maintaining healthy vision, skin health, and immune function (Dattola *et al*., 2020). The presence of this vitamin in *Landolphia owariensis* fruit contributes significantly to its health benefits and makes it a nourishing choice.

Antioxidant Properties: Defending Against Free Radicals

The health benefits of *Landolphia owariensis* fruit are not limited to its vitamins and minerals; its antioxidant properties deserve special attention. The data presented in Table 5 indicates the fruit's impressive antioxidant capacity. Antioxidants are crucial for neutralizing harmful free radicals, thus reducing oxidative damage in the body. The total phenolic content is particularly noteworthy, as phenolics are known for their anti-inflammatory and anti-cancer properties (Saleem *et al*., 2022). The combination of vitamins C and E enhances the fruit's ability to combat oxidative stress (Chen *et al*., 2022), making it a valuable addition to a balanced diet.

Nutrient Implications and Dietary Considerations

The compositional analysis of *Landolphia owariensis* suggests that it can be safely incorporated into a balanced diet. The high moisture content combined with moderate carbohydrate levels makes it a refreshing snack option. While the anti-nutritional factors present might raise some concerns, their concentrations are within acceptable limits for human consumption.

It's worth noting that the presence of these anti-nutritional compounds might actually contribute to the fruit's therapeutic properties, as many of these compounds have been associated with various health benefits when consumed in appropriate amounts. For instance, tannins are known for their antioxidant properties, while saponins have shown potential anti-inflammatory effects.

Understanding Anti-Nutrients in *Landolphia Owariensis* fruit

While *Landolphia owariensis* fruit is rich in nutrients, it's also important to consider the presence of anti-nutrients, which can hinder nutrient absorption. Common anti-nutrients include phytates, oxalates, and tannins. However, the concentration of these compounds in *Landolphia owariensis* fruit remains relatively low when compared to other fruits and vegetables.

Consuming the fruit in moderation and alongside complementary foods can mitigate the effects of these anti-nutrients. Moreover, methods such as soaking or cooking may help reduce the levels of certain anti-nutrients, allowing for better nutrient absorption.

Conclusion

In conclusion, *Landolphia owariensis* fruit stands out as a nutritional powerhouse. This analysis of the fruit provides valuable insights into its nutritional profile and anti-nutritional composition. The fruit's high moisture content, moderate carbohydrate levels, rich in essential vitamins, minerals, and relatively low anti-nutritional factors suggest it can be a healthy addition to diverse diets. With its impressive antioxidant properties, this fruit not only acts as a source of nourishment but also aids in defending the body against oxidative stress. Although

the presence of anti-nutrients should be acknowledged, they do not significantly diminish the overall health benefits this fruit provides.

As awareness grows around traditional and underutilized fruits like *Landolphia owariensis,* incorporating them into our diets could offer substantial health benefits and contribute to dietary diversity. Embracing such gifts from nature could truly transform our approach to nutrition.

While further research might be beneficial to fully understand its potential health impacts, current data indicates that *Landolphia owariensis* fruit is a safe and potentially beneficial fruit for consumption.

The findings contribute to the growing body of knowledge about tropical fruits and their nutritional value, helping to inform both dietary recommendations and potential commercial applications. As interest in diverse, sustainable food sources continues to grow, understanding the complete nutritional profile of fruits like *Landolphia owariensis* becomes increasingly important.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the research and publication of this work.

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