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## PHYTOCHEMICAL, PROXIMATE, AND ANTIOXIDANT PROPERTIES OF UGIRI FRUIT (*Irvingia gabonensis*)

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### Abstracts

*Irvingia gabonensis*, known as African bush mango, was analyzed for its phytochemical, proximate, acute toxicity, and antioxidant properties. The methanol pulp extract gave a percentage yield of 24.28%. The preliminary phytochemical analysis shows the presence of alkaloids, flavonoids, proteins, carbohydrates, tannins, resins, and terpenoids. The quantitative analysis shows that the extract contains 0.812 mg/g alkaloids, 0.903 mg/g flavonoids, and 0.98 mg/g steroids. The acute toxicity test showed that the plant is not toxic up to 500 mg/kg body weight. This suggests the safety of the plant for human and animal consumption. The proximate analysis revealed that the plant contains 2.53% fats, 78.8% moisture, 5.45% ash, 1.74% fiber, 8.1% carbohydrates, and 4.1% protein. The antioxidant activity of the pulp extract showed that the extract significantly ( $p < 0.05$ ) elevated the superoxide dismutase and glutathione concentrations of rats treated with carbon tetrachloride. The methanol pulp extract showed no significant ( $p > 0.05$ ) increase in the catalase activity of rats treated with CCL<sub>4</sub>. The plant has been shown to contain nutritional and antioxidant properties and is thus recommended for human consumption.

**Key words:** *Irvingia gabonensis*, antioxidant, glutathione, catalase, carbon tetrachloride.

## 1. Introduction

*Irvingia gabonensis*, commonly known as Ugiri fruit or African bush mango, is a tropical fruit native to West and Central Africa. It belongs to the Irvingiaceae family and is highly valued for its potential health benefits and culinary uses. Ugiri fruit has garnered significant attention due to its phytochemical composition, proximate analysis, and antioxidant properties, making it a subject of interest for researchers and health enthusiasts alike (Ngondi et al., 2009).

Phytochemicals are naturally occurring bioactive compounds found in plants, and they play a crucial role in the plant's defense mechanisms and interactions with the environment. These compounds have gained recognition for their potential health-promoting effects, such as antioxidant, anti-inflammatory, and anticancer properties. Exploring the phytochemical profile of Ugiri fruit could unveil valuable information about its medicinal and nutritional benefits.

In addition to phytochemicals, proximate analysis provides valuable insights into the essential nutritional components of a food source. It helps assess the content of macronutrients like proteins, carbohydrates, fats, and fibers, as well as moisture and ash content. Understanding the proximate composition of Ugiri fruit is essential for evaluating its potential as a dietary source and its contribution to human nutrition.

Antioxidants are substances that neutralize harmful free radicals in the body, protecting cells from oxidative stress and potential damage. Oxidative stress has been linked to various chronic diseases, including cardiovascular disorders, cancer, and neurodegenerative conditions. The presence of antioxidants in Ugiri fruit may confer health benefits by reducing oxidative damage and promoting overall well-being.

### Aim of study

The aim of this research work is to determine the proximate composition of ugiri fruit, the antioxidant composition of ugiri fruit and the lethal dose of ugiri fruit extract (*irvingia gabonensis*).

### Specific Objectives

The specific objectives of the study are to investigate the phytochemical profile, proximate composition, and antioxidant properties of Ugiri fruit. The findings from this research may shed light on the potential health advantages of incorporating Ugiri fruit into the diet and provide valuable information for the food and pharmaceutical industries. As the demand for natural and sustainable health products increases, understanding the nutritional and medicinal properties of Ugiri fruit could have significant implications for public health and nutrition

## 2. Materials and Methods

**Plant Material;** The leaves of *irvingia gabonensis* were used for this study. The leaves were purchased from Ogige market in Nsukka and were identified by Mr. C. C. Okonkwo of the Department of Biochemistry, University of Nigeria, Nsukka.

**Animals:** Fifteen (15) adult albino rats were used for the antioxidant studies and eighteen (18) adult albino mice were used for the acute toxicity study. All the animals used were bought from the animal house of the Faculty of Biological Sciences, University of Nigeria, Nsukka. The rats were fed with the Ugiri extract and water.

**Equipment;** were obtained from the laboratory of biochemistry department.

**Chemicals and reagents:** the chemicals and reagents used were bought from scientific shops in Nsukka and were of analytical grade, while some others were obtained from the laboratory of the department of biochemistry, University of Nigeria, Nsukka.

### 3. Methodology

#### **Preparation of plant material;**

The freshly collected leaves of *irvingia gabonensis* were dried; and milled to coarse powder using the hammer mill.

#### **Extraction of plant material:**

A weight quantity, 50.0g of the powdered plant was extracted with 250ml of methanol to obtain the extract. The extract was used for the antioxidant studies and acute toxicity test.

#### **Preparation of reagents for phytochemical analysis:**

Qualitative phytochemical analysis of *irvingia gabonensis* fruit.

The phytochemical analysis of the plant was carried out on fresh samples according to the method of Harborne (1973) to identify its active constituents of *irvingia gabonensis*.

Test for flavonoids, Test for alkaloids, Test for glucoside, Test for proteins, Test for carbohydrates, Test for reducing sugars, Test for saponins, Test for tannins, Test for oils, Test for resins, Test for steroids, Test for terpenoids.

#### **Quantitative phytochemical analysis of *irvingia gabonensis* fruit:**

**Alkaloid determination:** The determination of alkaloid was as described by Harbone (1973).

**Determination of flavonoids;** This was determined according to the method of Harbone (1973).

**Determination of steroids;** This was determined by the method described by Okeke and Elekwa (2003).

**Determination of antinutrient contents of *irvingia gabonensis*:** The method of Swain (1979) was used for the determination of tannin contents of *irvingia gabonensis*.

**Proximate analysis of *irvingia gabonensis*:** The AOAC (1990) method was used to determine the proximate constituents of *irvingia gabonensis*.

**Determination of moisture content** Determination of fat content; Fat content was determined by the soxhlet method (AOAC, 1984).

Determination of crude fibre content

Determination of ash content.

Determination of protein content

Determination of carbohydrate content

Determination of vitamin A, C and E content of *irvingia gabonensis*.

The vitamin assay was performed with the method of Pearson (1976).

Vitamin A

Vitamin E.

Vitamin C.

Acute toxicity test using ethanol extract of *irvingia gabonensis*.

The method of Lorke (1983) was used for the acute toxicity test of the methanol extract of *irvingia gabonensis*.

#### **Antioxidant study.**

The antioxidant was carried out by the method described by Zibamokhberi (2014)

Preparation of methanol extract for antioxidant assay.

Experiment design for the antioxidant studies

#### **4. Results**

##### **Percentage Yield of Ethanol Extract.**

The method pulp extract gave a percentage yield of 24.28 %.

##### **Phytochemical Analysis of *Irvingia Gabonensis* Fruit.**

The preliminary screening of the pulp shows that the extract contains alkaloids, flavonoids, resins, steroids, proteins, reducing sugars, carbohydrates with the absence of glycosides terminal, as shown in the table below.

##### **The phytochemical constitution of *Irvingia gabonensis***

Constituent	Inference
1. Alkaloids	++
2. Glycosides	-
3. Flavonoids	++
4. Saponins	+
5. Tannins	-
6. Resins	+
7. Steroids	++
8. Terpenoids	++
9. Proteins	++
10. Reducing sugar	+++
11. Carbohydrate	+

##### **Key**

- : Absent

+ : Slightly present

++ : Moderately present

+++ : Highly present

### The Quantitative Analysis of *Irvingia Gabonensis* Fruit.

Phytochemicals	Quantity (mg/g)
Alkaloids	0.8115
Flavonoids	0.9034
Steroids	0.9800

Source: Field Survey, 2023

### The Proximate Composition of *Irvingia Gabonensis* Fruit

The proximate analysis of the plant showed that the plant contains 2.53 % of fats, 78.06 % moisture, 5.45 % ash, 1.7 % fibre, 8.11 % carbohydrate, and 4.12 % proteins as shown in the table below;

Plant	Fats%	Moisture%	Ash%	Fibre%	Carbohydrate%	Protein%
<i>Irvingia gabonensis</i>	2.526	78.057	5.450	1.742	8.11	4.115

Source: Field Survey, 2023

### The Acute Toxicity Test (LD<sub>50</sub>) of *Irvingia Gabonensis* Fruit.

Stage one of the toxicity test

Group	Dosage mg/kg bwt	Mortality in <i>I. gabonensis</i>
Group 1	10	0/3
Group 2	100	0/3
Group 3	1000	0/3

Source: Field Survey, 2023

### Stage two of the toxicity test

Group	Dosage mg/kg bwt	Mortality in <i>I. gabonensis</i>
Group 1	1600	0/3
Group 2	2900	0/3
Group 3	5000	0/3

Source: Field Survey, 2023

The acute toxicity test of the methanol pulp extract showed that the plant extract is not toxic up to 5000mg/kg bwt.

The effect of methanol extract of *irvingia gabonensis* fruit on SOD level.

The effect of methanol extract of *irvingia gabonensis* fruit on CAT level.

The effect of methanol extract of *irvingia gabonensis* fruit on GSH level.

## Discussion

The African bush mango (*irvingia gabonensis*) fruit. The percentage yield of the pulp extract was found to be 24.28 %. Qualitative phytochemical analysis revealed the presence of alkaloids, flavoids, resins, steroids, terpenoids and proteins as well as reducing sugar and carbohydrates. Results of quantities determination of alkaloids, flavonoids and steroids were 0.81 mg/g, 0.90 mg/g and 0.9mg/g respectively. The proximate composition of the extract was found to be 2.53 % for fats, 1.74 % fibre, 8.11 % carbohydrate, 4.12 % protein as well as moisture (78.06 %) and ash (5.45 %). The extract showed no toxicity at a dose of 5000mg/kg body weight.

### Phytochemical Profile:

The preliminary phytochemical analysis of Ugiri fruit extract revealed the presence of various bioactive compounds, including alkaloids, flavonoids, proteins, carbohydrates, tannins, resins, and terpenoids. These phytochemicals are known to possess diverse medicinal properties and have been associated with potential health benefits. Alkaloids, for instance, are known for their analgesic and anti-inflammatory effects, while flavonoids are renowned for their antioxidant and anti-cancer properties. The presence of these phytochemicals in Ugiri fruit suggests its potential as a natural source of bioactive compounds that could contribute to overall health and well-being.

### Proximate Composition:

The proximate analysis of Ugiri fruit indicated its nutritional composition in terms of macronutrients and other essential components. The fruit was found to contain 2.53% fats, 78.8% moisture, 5.45% ash, 1.74% fiber, 8.1% carbohydrates, and 4.1% protein. These values provide valuable information about the nutritional profile of Ugiri fruit and its potential as a dietary source. The significant moisture content suggests the fruit's succulence, making it a hydrating and refreshing option for consumers. The presence of fats, carbohydrates, and proteins highlights its potential as a source of energy and essential nutrients.

### Antioxidant Properties:

The antioxidant activity of Ugiri fruit extract was assessed by measuring its effects on the concentrations of superoxide dismutase (SOD) and glutathione in rats treated with carbon tetrachloride (CCL<sub>4</sub>), a known oxidative stress inducer. The results demonstrated a significant elevation of SOD and glutathione concentrations in rats treated with Ugiri fruit extract, indicating its potential to counteract oxidative stress. The presence of antioxidants in Ugiri fruit is particularly valuable as oxidative stress is associated with various chronic diseases and aging processes. By neutralizing harmful free radicals, Ugiri fruit's antioxidant properties may play a role in promoting cellular health and mitigating oxidative damage.

### Glutathione Activity:

In addition to evaluating the antioxidant activity of Ugiri fruit extract through superoxide dismutase (SOD) concentrations, the study also assessed its impact on Glutathione levels. Glutathione is a crucial endogenous antioxidant that plays a significant role in the body's defense against oxidative stress and detoxification of harmful substances. The results indicated a significant elevation in Glutathione concentrations in rats treated with Ugiri fruit extract, suggesting its potential in enhancing the body's antioxidant defense system.

The observed increase in Glutathione levels further highlights the antioxidant properties of Ugiri fruit and its ability to combat oxidative damage. Glutathione's role as a master antioxidant is particularly essential in neutralizing free radicals and reactive oxygen species, thereby protecting cells from oxidative stress-induced damage. By augmenting Glutathione levels, Ugiri fruit extract demonstrates its potential to enhance the body's ability to counteract oxidative stress and maintain cellular health. These findings are promising and indicate that Ugiri fruit may be a valuable dietary addition to promote antioxidant defense and protect against oxidative stress-related disorders.

## 5. Conclusion and Recommendations

### Conclusion

From the phytochemical test carried out, it has been revealed that *invingia gabonensis* fruit is a very good antioxidant. And has been discovered that *invingia gabonensis* can be very useful in treatment of obesity and can help to scavenge and repress the activities of the reactive oxygen species. Overall, the findings of this study underscore the potential health-promoting properties of Ugiri fruit. Its phytochemical composition, proximate nutritional content, Glutathione activity and antioxidant activity make it a promising natural resource with potential applications in the food and pharmaceutical industries.

### Recommendations

- i. Given the presence of essential nutrients such as fats, proteins, carbohydrates, and dietary fiber in *Invingia gabonensis*, it is recommended for incorporation into diets as a potential source of nutritional benefits.
- ii. The results of the acute toxicity test, which indicated that the plant is not toxic up to a dose of 500 mg/kg body weight, suggest that *Invingia gabonensis* can be safely consumed by both humans and animals without adverse health effects.
- iii. The antioxidant properties of the methanol pulp extract, as evidenced by its ability to elevate superoxide dismutase and glutathione concentrations, make *Invingia gabonensis* a potential candidate for inclusion in diets aimed at improving antioxidant defense mechanisms in the body.
- iv. Due to the presence of phytochemicals such as alkaloids, flavonoids, tannins, and terpenoids, *Invingia gabonensis* holds promise for contributing to health-promoting effects in consumers. Further research into the specific health benefits associated with these phytochemicals is recommended.
- v. As the proximate analysis revealed a variety of components, including moisture, ash, and carbohydrates, the plant could be used to enhance the nutritional diversity of diets, contributing to a balanced intake of essential nutrients.
- vi. While the methanol pulp extract did not significantly increase catalase activity, additional research could explore its potential effects on this enzyme and other oxidative stress markers in different experimental settings.

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