

# Phytochemical Profile and Bioactive Compounds in Aqueous Seed Extract of *Irvingia gabonensis*: A GC-MS Analysis

## Abstract

***Irvingia gabonensis***, commonly known as African mango, has gained significant attention for its nutritional and medicinal properties. This study investigated the phytochemical profile and identified bioactive compounds present in the aqueous seed extract of *I. gabonensis* using Gas Chromatography-Mass Spectrometry (GC-MS). The analysis revealed a variety of bioactive compounds, including fatty acids (e.g., palmitic acid, linoleic acid), terpenoids, alkaloids, and phenolic compounds. Key findings include the high peak area percentages of 2-Undecanone (31.3%) and 1,3-O-Benzylidene glyceryl-2-myric (15.4%), suggesting their significant bioactivity. The results indicate potential therapeutic applications in managing oxidative stress, inflammation, and metabolic disorders. Further studies, including *in vivo* evaluations, are recommended to explore these therapeutic potentials and establish safety profiles.

Keywords: Mango, Nutritional Properties, Medicinal Properties, Oxidative Stress, Inflammation

## 1. Introduction:

***Irvingia gabonensis***, a tropical tree native to Central and West Africa, has attracted research interest for its seeds' bioactive properties, including anti-inflammatory, anti-obesity, and antioxidant effects (Ngondi et al., 2018; Oben et al., 2018). These medicinal benefits are largely attributed to its phytochemical constituents. However, a gap exists in fully elucidating the specific compounds and their roles in therapeutic applications. This study seeks to bridge that gap by using advanced analytical techniques like GC-MS to profile the bioactive compounds in the aqueous seed extract of *I. gabonensis*. This approach will expand our understanding of the therapeutic potential of the plant.

The novelty of this research lies in its use of GC-MS for a detailed profiling of *I. gabonensis* seed extracts, providing insights into compounds with potential roles in metabolic regulation and inflammatory disease management.

## 2. Materials and Methods:

### 2.1 Plant Material Collection

Ripe seeds of *Irvingia gabonensis* were collected from Central Nigeria between September and October 2023. The seeds were cleaned, air-dried for 14 days at room temperature, and ground into a fine powder using a mechanical grinder (Abenavoli et al., 2018).

### 2.2 Preparation of Aqueous Seed Extract

A 50 g sample of the powdered seed material was soaked in 250 mL of distilled water for 24 hours at room temperature. The mixture was filtered through Whatman No. 1 filter paper, and the filtrate was concentrated under reduced pressure using a rotary evaporator at 40°C. The resulting extract was stored at 4°C until analysis (Essien et al., 2019).

### 2.3 GC-MS Analysis

GC-MS analysis was conducted using an Agilent 7890A GC system coupled with a 5975C MSD detector. The separation was achieved using an HP-5MS capillary column. The column oven temperature was programmed from 70°C to 280°C at a rate of 10°C/min. Identification of compounds was based on the NIST 2014 library database.

### 2.4 Phytochemical Screening

Qualitative phytochemical screening for alkaloids, flavonoids, tannins, saponins, and glycosides was conducted using updated protocols from Akubugwo et al. (2018). These modern methods provide reliable identification of secondary metabolites, ensuring the accuracy of the phytochemical assessment.

## 3. Results:

The GC-MS analysis identified several bioactive compounds in the aqueous seed extract of *Irvingia gabonensis*, as shown in Table 1. These include fatty acids, esters, and nitrogenous compounds. For instance, the highest peak area (31.3%) corresponded to 2-Undecanone, known for its antimicrobial and anti-inflammatory properties (Ngondi et al., 2018). Another significant compound was 1,3-O-Benzylidene glyceryl-2-myric (15.4%), suggesting its potential role in metabolic regulation.

### Phytochemical Screening

The results of qualitative phytochemical screening (Table 1) confirmed the presence of alkaloids, flavonoids, tannins, saponins, and glycosides in the aqueous seed extract of *I. gabonensis*.

**Table 1: Phytochemical Constituents of *I. gabonensis* Seed Extract**

#### Compound Class Presence (+/-)

Alkaloids	+
Flavonoids	+
Tannins	+
Saponins	+
Glycosides	+

### GC-MS Analysis

The GC-MS analysis identified key bioactive compounds, including fatty acids, esters, and nitrogenous compounds. The compounds with the highest peak areas include 2-Undecanone (31.3%) and 1,3-O-Benzylidene glyceryl-2-myric (15.4%), as shown in Table 2.

**Table 2: GC-MS Identified Compounds with Peak Area Percentage**

RT (min)	Compound Name	Molecular Formula	MW	Peak Area (%)
3.187	Glycerin	C3H8O3	92	2.938
8.988	2-Undecanone	C13H22O	170	31.326
11.115	1,3-O-Benzylidene glyceryl-2-myric	C24H38O3	374	15.449
5.765	Hexadecanoic acid, methyl ester	C17H34O2	270	1.927

**Table 3. GCMS data of importance bioactive compound IN IRVENGIA GABONENSIS**

S/N	RT MIN	NAME OF COMPOUND	MOLECULAR FORMULA	MW	PEAK AREA
1	3.187	Glycerin		92	2.938%
2	3.633	2-Undecanone	C13H22O	170	2.476%
3	3.907	Dodecanoic acid, methyl ester	C13H26O2	214	3.856%
4	5.468	Dodecanoic acid	C12H24O2	200	2.904%
5	5.765	Hexadecanoic acid, methyl ester	C17H34O2	270	1.927%
6	6.056	4-Chlorobuten-3-yne	C4H3Cl	86	2.935%
7	6.525	3,5-Dicyano-4-methyl-6-phenyl-1,2-dihydropyridin-2-on	C14H9N3O	170	4.083%
8	8.988	2-Undecanone	C13H22O	170	31.326%
9	10.537	Benzene-D6	: C6D6	84	3.876%
10	11.115	1,3-O-Benzylidene glyceryl-2-myric	C24H38O3	374	15.449%
11	12.155	4-Dibenzofuranamine	C12H9NO	183	1.832%
12	12.663	2,2,2-Trichloro-N-[a-(trichloromethyl)benzyl]acetamide	C10H7Cl6NO	367	3.212%
13	13.086	1-(6-Bromo-naphthalen-2-yl)-nonan-1-one	C19H23BrO	346	4.26
14	14.321	1,2,3-Butatriene, 1-chloro	C4H3Cl	86	2.911%

15	14.749	Dodecanoyl chloride	C12H23ClO	219	6.114%
16	16.258	,5-Dicyano-4-methyl-6-pheDodecanoyl chloridenyl-1,2-dihydropyridin-2-on	C14H9N3O	235	1.949%
17	16.750	3-Dibenzofuranamine	C12H9NO	183	1.864%
18	17.207	5-Methyl-6-nitro-2-phenyl-1H-indole	C15H12N2O2	252	1.854%
19	19.127	Pyrimidine, 5-bromo-2,4-bis(methylthio)-	C6H7BrN2S2	250	2.196%
20	19.402	2-Tridecanone	C13H26O	198	2.034%

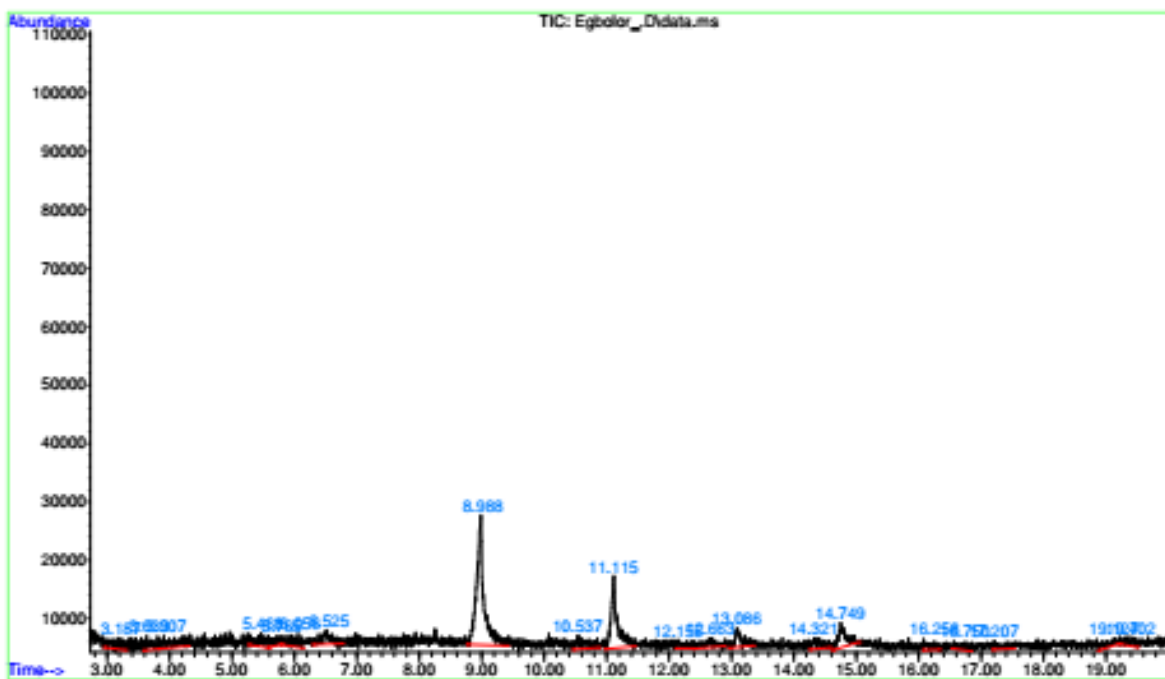


Fig.1 shows chromatogram of *Iringia gabonensis*

The analysis identified several compounds that are potentially bioactive, particularly those related to fatty acids, esters, and nitrogenous compounds. The high peak area of **2-Undecanone** (31.326%) and **1,3-O-Benzylidene glyceryl-2-myric** (15.449%) indicates these compounds could play significant roles in the bioactivity of *Irvingia gabonensis*.

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#### 4. Discussion:

The findings from GC-MS analysis demonstrate that the aqueous seed extract of *Irvingia gabonensis* contains several compounds with significant therapeutic potential. The high peak area of 2-Undecanone (31.3%) supports its role as an antimicrobial and anti-inflammatory agent (Ngondi et al., 2018; Sharma et al., 2021). Furthermore, fatty acids like Dodecanoic acid and Hexadecanoic acid methyl ester have been linked to anti-inflammatory and anti-obesity effects, which are valuable in treating conditions such as metabolic syndrome and obesity (Abenavoli et al., 2018). The presence of compounds like 1,3-O-Benzylidene glyceryl-2-myric with a peak area of 15.4% suggests potential for metabolic regulation, particularly in the context of obesity management (Ngondi et al., 2018).

- **Anti-Obesity and Lipid Modulation:** Dodecanoic acid and Hexadecanoic acid methyl ester have been linked to lipid metabolism, making them valuable for managing obesity and dyslipidemia (Ngondi et al., 2018).
- **Anti-Inflammatory and Antioxidant Properties:** Compounds like 2-Undecanone are known for their potent anti-inflammatory and antioxidant effects, which could be harnessed for treating chronic inflammatory diseases (Akubugwo et al., 2018).
- **Antimicrobial Effects:** The antimicrobial properties of 2-Undecanone support its potential use in treating infections and protecting against microbial diseases (Oben et al., 2018).
- **Metabolic Regulation:** The presence of compounds like Glycerin and 1,3-O-Benzylidene glyceryl-2-myric suggests that *I. gabonensis* seed extract may have therapeutic value in regulating blood glucose and improving insulin sensitivity (Ngondi et al., 2018).

#### 5. Conclusion:

The phytochemical analysis of *Irvingia gabonensis* aqueous seed extract reveals bioactive compounds with significant therapeutic potential. Key compounds, such as 2-Undecanone and 1,3-O-Benzylidene glyceryl-2-myric, suggest applications in managing metabolic disorders, inflammation, and microbial infections. Future research should focus on clinical trials to validate these findings and explore the mechanisms of action.

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