

Evaluation of the physico-chemical properties of Niger (*Guizotia abyssinica* Cass) seeds and oil

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Abstract

The focus of agricultural research has been on staple crops, with little on underutilized species. One such is *Guizotia abyssinica* (Niger), a vibrant herbaceous plant with striking yellow flowers from the Asteraceae family. This study analysed the nutraceutical properties of *G. abyssinica* seeds and oil, via standard analytical methods. Comprehensive analysis revealed a balanced nutritional profile with significant protein (6.7%) and lipid (26%) content. Essential minerals (K: 3.071 mg/g, Fe: 0.110 mg/g, Ca: 11.890 mg/g, and Mg: 1.371 mg/g) were identified, highlighting their nutritional value. Linoleic acid dominated the oil's fatty acid profile (74.608%), followed by traumatic acid (5.019%) and palmitic acid (3.692%). The oil exhibited favourable properties (high iodine value: 200.5 g I₂/100g, low acidity: 2.2 mg KOH/g) and strong antioxidant activity (IC₅₀ = 6.953 mg/ml). Various bioactive compounds, including saponins, alkaloids, and phenols were identified. Spectrophotometric properties, including a UV-Visible λ_{max} of 340 nm and strong FTIR peaks at 1742.59 cm⁻¹ (carbonyl stretching), and at 2360.35 cm⁻¹ and 2852.68 cm⁻¹ (suggesting the existence of alkynes and alkanes), provide reference spectra for quality assessment. These findings emphasize the nutritional significance of *G. abyssinica* seeds, suggesting applications in food science, nutrition, and allied industries as well as its chemical composition contributing to understanding this underexplored plant.

Keywords: Antioxidant properties, Fatty acid, Industrial application, Proximate composition, Spectrophotometric properties

1. Introduction

In agricultural research, the focus has largely been on staple crops, often side-lining minor underutilized species. One such species is the Niger, a vibrant herbaceous plant with striking yellow flowers from the Asteraceae family, known scientifically as *Guizotia abyssinica* (*G. abyssinica*) (Elbermawi et al., 2022; Shivarkar & Kashid, 2020; Getinet & Sharma, 1996). This plant, which boasts a wide range of uses, is native to Africa, specifically Ethiopia, Eritrea, and Malawi (Elbermawi et al., 2022; Shivarkar & Kashid, 2020; Geleta & Ortiz, 2013). Countries like Tanzania, the West Indies,

Bangladesh, Nepal, Zimbabwe, Uganda, Malawi Zaire, Sudan and USA have limited supplies of *G. abyssinica* seeds (Gebeyehu et al., 2021; Fatima et al., 2015; Getinet & Teklewold, 1996). In Nigeria it is cultivated on a small scale by peasant farmers, particularly in parts of Plateau State. *G. abyssinica* plant has seeds that are versatile in their uses.

G. abyssinica plant is a significant source of edible seed oil (Shivarkar & Kashid, 2020; Sumeet & Seema, 2012; Getinet & Sharma, 1996) which is particularly notable for their high content of linoleic acid, an unsaturated fatty acid with many health benefits, including the prevention of heart diseases (Elbermawi et al., 2022; Getinet & Tklewold, 1995). The seed, and its crude oil, have been widely used in traditional nutritional and medicinal applications (Gorse et al., 2022; Ramadan, 2012; Getinet & Sharma, 1996). The seeds and oil are consumed by human beings, and the plant is used as green manure and consumed by animals, particularly sheep. The seeds are often crushed and mixed with other foods in Ethiopia, while in Nigeria they are roasted, ground and used as a garnish for various dishes and meat. The oil extracted from the seeds is used for cooking, lighting, painting, and in pharmaceutical applications (Getinet & Sharma, 1996). The remaining meal after extraction is rich in protein and fibre and can be used as animal feed (Getinet & Sharma, 1996). In addition, the oil and sprouts of the plant have medicinal uses, including treatment of coughs and potentially as a birth control method (Gorse et al., 2022; Sumeet & Seema, 2012; Getinet & Sharma, 1996).

Over and above their traditional uses, *G. abyssinica* seeds have become a subject of scientific study due to their potential nutritional, industrial, and medicinal benefits (Elbermawi et al., 2022; Gebeyehu et al., 2021; Ramadan, 2012). While there have been studies on the seed oil content, fatty acid composition, and nutritional value of *G. abyssinica* cultivated in some countries such as Ethiopia, India, and USA (Elbermawi et al., 2022; Fatima et al., 2015), there is a need for studies on seeds from all the areas where the plant is cultivated. This is because the nutrient profile of oilseeds can be influenced by several factors, including species, type, maturity, environmental conditions, breeding objectives, and management practices (Tsehay et al., 2021; Fatima et al., 2015; Getinet & Teklewold, 1995). Moreover, comprehensive studies that fully explore the nutritional potential of *G. abyssinica* seeds are lacking.

This study aims to provide a comprehensive analysis of the characterization and properties of *G. abyssinica* obtained from Bokkos local government area of Plateau State, Nigeria. Our goal is to contribute to the understanding and development of this underutilized crop, promote its sustainable conservation, and unlock its full potential. We believe that while staple crops are vital to man's food supply, the significance of minor or neglected crops like *G. abyssinica* should not be overlooked as they not only contribute to food security and nutrition but also have the potential to survive in marginal growing conditions (Gorse et al., 2022; Getinet & Sharma, 1996), making them inevitable in the face of climate change and increasing food demand.

2. Materials and method

2.1. Sample collection and preparation

Seeds of *G. abyssinica* were procured from a market in Bokos, Plateau State, Nigeria. After thorough cleaning and sorting, the seeds were sieved using a 0.6mm sieve with an electric shaker to remove debris and unwanted seeds. The cleaned seeds were then blended and stored in a polythene bag.

2.2. Determination of proximate composition of seed

The seeds underwent analysis for moisture content, ash, crude protein, crude fat, crude fiber, and carbohydrates using standard methods. The moisture, crude lipid, and crude fiber contents were determined as per (Udo & Oguwele, 1986), crude protein was determined using the micro-Kjeldahl method (AOC, 1990), while ash content and total carbohydrate content were determined as per James (Jams, 1995).

2.3. Determination of elemental composition of seed

A 1g of the seed sample was digested with 10ml of HNO₃, filtered into a 100ml volumetric flask, made up to mark and analyzed using Thermos Scientific iCE 3000 series spectrometer. The spectrometer results converted from mg/L to mg/kg of seed using the following:

$$\text{Concentration} = \frac{C_s - C_b}{m} \times 100 \quad 1$$

Where m is mass (g) of digested seed sample, C_s and C_b are the concentrations (mg/L) of the seed sample and blank respectively.

2.4. Extraction of oil from seeds using n-hexane

A 60g seed sample was placed in a cellulose thimble and extracted with n-hexane in a Soxhlet apparatus for 9 hours. The n-hexane was evaporated, and the remaining oil was dried and weighed repeatedly until the weight difference was less than 10%. The yield was calculated as a percentage of the initial dry seed weight.

$$\text{Yield (\%)} = \frac{\text{weight of oil (g)}}{\text{weight of seed (g)}} \times 100 \quad 2$$

2.5. Determination of physico-chemical properties of seed oil

The oil's properties, including density, refractive index, iodine value, peroxide value, acidity, and saponification value, were measured as per AOAC (1990). Viscosity was determined using an ND-5S viscometer. Smoke and melting points were found by heating the oil until boiling. Light transmission was assessed against a bulb, color was compared to a chart, and density was measured using a 25ml bottle.

2.6. Determination of antioxidant property

The antioxidant property of the oil was determined using the DPPH method. A stock solution was prepared by dissolving 200mg of oil in 20ml of ethanol. Concentrations of 10, 5, 2.5, 1.25, and 0.625 mg/ml were created through serial dilution. Each concentration was mixed with DPPH solution and left in a dark cupboard for 20 minutes. Absorbance was measured at 517nm using UV-Visible spectrometer (6850 UV/Vis. Spectrophotometer, JENVA, China). The percentage inhibition was calculated using the formula:

$$\% \text{ Inhibition} = \frac{A_0 - A_s}{A_0} \times 100 \quad 3$$

Where A_0 is the absorbance of the blank. The IC₅₀ value was calculated from the linear regression plot of the antioxidant activity against the oil concentration, represented by the equation:

$$\% \text{ Inhibition} = mC \pm I \quad 4$$

Where m is the slope and I is the intercept of the plot.

2.7. Qualitative phytochemical properties

Qualitative tests were conducted as per Emmanuel et al. (2016) to identify the presence or absence of phytochemical compounds, including alkaloids, flavonoids, tannins, saponins, steroids, glycosides, phenols, terpenoids, volatile oils, sterols, phlobatannins, and resin.

2.8. GCMS analysis of fatty acid profile of seed oil

A 400mg oil sample was saponified in a flask with 4ml of 0.5M methanolic KOH, heated at boiling point for 15 minutes. Then, 1.6ml of methanolic HCl (HCl: MeOH, 4:1) was added and heated for another 25 minutes. After cooling, 8ml of deionized water was added. Fatty Acid Methyl Esters (FAMES) were extracted using 6ml of n-hexane, repeated twice for a total of 15ml. The n-hexane aliquot was dried using Sodium sulfate for GC-MS analysis.

The analysis was conducted on an Agilent GCMSD system with a HP-5ms Ultra Inert column (30 m x 250 μ m x 0.25 μ m), using helium as the carrier gas at an average velocity of 31.147 cm/sec. The oven temperature was initially set at 40 °C for 2 minutes, then increased to 180 °C at 15 °C/min, followed by a 3 °C/min increase to 205 °C, and finally an 8 °C/min ramp to 300 °C, maintained for 7 minutes. 2 μ L sample was injected in split mode (split ratio 5:1) at 250 °C. FAMES were identified based on their retention times compared with FAME standards. The MS analysis was performed in SIM/Scan mode with a mass range from 46 to 600 amu and a dwell time of 100 ms for 18 specific ions. Data acquisition was controlled by Agilent MassHunter software.

The concentrations (%) of the fatty acid derivatives obtained from the GCMS results were converted to their equivalent fatty acids concentrations (%) and normalized to 100%. Similarly, the concentrations of the non-fatty acid components were normalized to 100%.

2.9. Determination of spectrophotometric characteristics of oil

The molecular structure and functional groups present in *G. abyssinica* seeds oil were investigated using Thermoscientific Nicolet iS5 FT-IR equipped with iD7 ATR accessory in neat mode. UV-Vis spectrometry of the oil, both with and without solvent, was conducted using a 6850 UV/Vis Spectrophotometer from JENVA, China. The conditions for the spectrometry were as follows: Scan Range of 190.0-1100.0nm, Scan Step of 1.0nm, and Scan Filter of 10. The spectrum was recorded as a plot of absorbance against wavelength, and then the data was re-plotted.

3. Results and discussions

3.1. Proximate composition of seed

The proximate composition of *G. abyssinica* seeds, as shown in Figure 1, underscores their key nutritional attributes. The seeds exhibit good stability, indicated by a low moisture content of 5.7670% (± 0.2). The ash content of 3.081% (± 0.4) suggests a noteworthy mineral profile, which is lower than that found in Niger meal (7.31%) in a study by Naz et al. (2021). The high crude fiber content of 26.370% (± 0.3) positions these seeds as a potential dietary source for digestive health (Deme et al., 2017). The seeds are also a significant source of fats, with a rich crude lipid content of 25.989% (± 0.5), higher than the lipid content in Niger meal (7.16%) reported in a study by Naz et al. (2021). The protein content is moderate at 6.706% (± 0.2), contributing to the overall nutritional value. The carbohydrate content of 32.089% (± 0.3) establishes the seeds as a significant energy source (Geleta & Ortiz, 2013). The fat, ash and carbohydrate contents were found to be similar to those reported in the literature, except the fat content (37.5g/100g) reported by Lima et al. (2021) which is higher.

These finding on the proximate composition of *G. abyssinica* seeds collectively position it as a promising and versatile nutritional resource.

Table 1: Proximate composition of *G. abyssinica* seed

Parameter	Value
Moisture content (%)	5.7670 \pm 0.2
Ash content (%)	3.081 \pm 0.4
Crude fiber (%)	26.370 \pm 0.3
Crude lipid (%)	25.989 \pm 0.5
Crude protein (%)	6.706 \pm 0.2
Carbohydrates (%)	32.089 \pm 0.3

3.2. Metal composition of seed

The seeds of *G. abyssinica* displays a rich elemental composition, as illustrated in Table 2, with notable levels of essential minerals such as K (3.071 mg/g), Fe (0.110 mg/g), Ca (11.890 mg/g), and Mg (1.371 mg/g). These findings underscore their potential as a nutrient-dense dietary source. These minerals are vital for various Physiological processes, aiding muscle contraction, oxygen transport, bone health, and energy metabolism (Kibiti & Afolayan, 2015). Additionally, trace elements like Zn, Mn, and Cu contribute to antioxidant defense and immune system support (Mezzaroba et al., 1019). Monitoring trace elements, including Cd, Pb, Cr, Co, Ni, and Na, is crucial to ensure they meet safety standards for consumption. Notably, Na (0.662 mg/g), and Pb (0.556 mg/g) are the most concentrated among these trace elements, as shown in Table 2. The elemental composition of these metals exhibit both similarities and differences when compared to results from various varieties of Niger seeds from different regions in Ethiopia, as reported by Deme et al. (20170 AND Syume & Chandravanshi (2015). In summary, *G. abyssinica* seeds offer a valuable source of essential minerals, contributing to their potential health benefits.

Table 2: Metallic composition (mg/g) of *G. abyssinica* seed

Zn	Mn	Mg	Cd	Pb	Cr	Co	K	Fe	Ca	Cu	Ni	Na
0.032	0.113	1.371	0.025	0.556	0.060	0.005	3.071	0.110	11.890	0.033	0.049	0.662

3.3. Physico-chemical properties of seeds

The seeds of *G. abyssinica* yielded an oil content of 26.1369 ± 0.3 , presenting a substantial source of oil. The physico-chemical properties of the extracted oil are shown in Table 3. The properties reveal characteristics conducive to various applications. The acid value (2.244 ± 0.1 mgKOH/g) which is less than Codex standard for Named Vegetable Oils (0.6 mgKOH/g), suggests a low level of free fatty acids, indicating good oil quality (Bhatnagar et al., 2009). The iodine value (200.502 ± 0.1 wijs) indicates the oil's unsaturation level, influencing its stability and potential industrial uses (Bhatnagar et al., 2009). The peroxide value (22.000 ± 0.3 mEq/Kg) reflects the oil's oxidative stability, crucial for maintaining its quality during storage (Bhatnagar et al., 2015), is higher than the Codex Standard for Named Vegetable Oils (CODEX_STAN210-1999), which is 10 meq/kg for Niger seed oil. According to CODEX_STAN210-1999, the saponification value of Niger seed oil is 188-192 mgKOH/g. The saponification value observed in this study, 203.363 ± 0.2 mgKOH/g, slightly exceeds the CODEX standard. This finding offers insights into the oil's fatty acid composition and contributes to its functional properties (Gebeyehu et al., 2021). The oil's low free fatty acid content, 1.122 ± 0.1 mgKOH/g, indicates minimal hydrolytic degradation.

The viscosity of the oil, 81.5 ± 1.9 mPa.S, falls within a desirable range for various applications, highlighting its fluidity. The oil's high smoke point, 220.0 ± 4.0 °C, and boiling point, 287.2 ± 2.0 °C, render it suitable for cooking, while its relative density, 0.909 ± 0.2 , meets established standards. The yellow color and transparency of the oil suggest purity, enhancing its suitability for culinary and industrial purposes (Gebeyehu et al., 2021).

Overall, the physico-chemical properties of *G. abyssinica* oil reveals its potential for a wide range of applications, including culinary and industrial uses, due to its favorable oxidative stability, fatty acid composition, and thermal characteristics.

Table 3: Physico-chemical properties of *G. abyssinica* seed

Property	Value
Acid value (mgKOH/g)	2.244 ± 0.1
Iodine value (wijs)	200.502 ± 0.1
Peroxide value (mEq/Kg)	22.00 ± 0.3
Saponification value (mgKOH/g)	203.363 ± 0.2
Free fatty acid (mgKOH/g)	1.122 ± 0.1
Viscosity (mPa.S)	81.5 ± 1.9
Smoke point (°C)	220.0 ± 4.0
Boiling point (°C)	287.2 ± 2.0
Relative density	0.909 ± 0.2
Color	Yellow
Transparency	Transparent

3.4. Antioxidant property of seed

The correlation between concentration (mg/ml) and inhibition efficiency (%) of *G. abyssinica* seed oil, an economically vital edible oilseed crop (Geleta & Ortiz, 2013), is illustrated in figure 1. The oil exhibits significant antioxidant properties, as demonstrated by its dose-dependent inhibition of 66.86%, 38.76%, 26.92%, 18.05%, and 12.72% at concentrations of 10.000 mg/ml, 5.000 mg/ml, 2.500

mg/ml, 1.250 mg/ml, and 0.625 mg/ml, respectively. This strong antioxidant property of the oil is highlighted by an IC₅₀ value of 6.953 mg/ml, which represents the necessary concentration to halve the initial DPPH concentration (Lima et al., 2021). This observation is consistent with Elbermawi et al. (2022), who also reported notable antioxidant activity in *G. abyssinica* extract. However, the IC₅₀ value mentioned in our study seems to be lower than what is typically reported in the literature, possibly due to differences in the extraction process, the part of the plant used, or the specific assays used to measure antioxidant activity.

These findings highlight the potential of *G. abyssinica* seed oil as a natural antioxidant, valuable for various applications in the food and pharmaceutical industries. This aligns with the findings of Geleta and Ortiz (2013), who highlighted the significance of Niger for sustainable food security in Ethiopia.

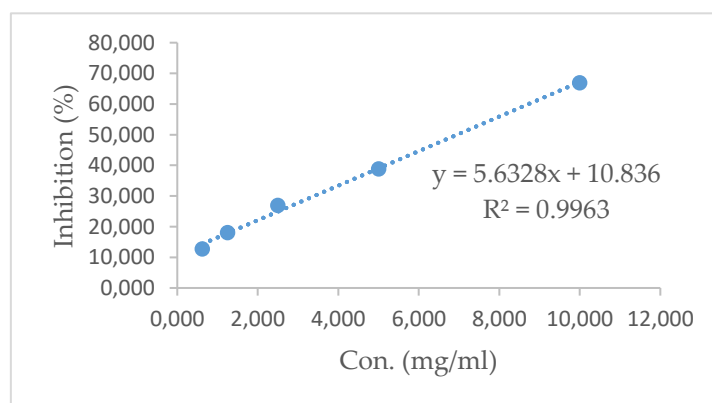


Figure 1: Graph of concentration (mg/ml) of *G. abyssinica* against inhibition (%)

3.5. Qualitative phytochemical composition of seed oil

The examination of *G. abyssinica* seed oil for phytochemical content, as detailed in Table 4, indicates the existence of a range of bioactive substances. Identified substances such as saponins, alkaloids, phenols, glycosides, cardiac glycosides, steroids, terpenoids, volatile oil, and sterol are recognized for their possible health-promoting properties (Gorse et al., 2022). The lack of tannins, flavonoids, quinone, phlobatannins, and resin points to a distinctive phytochemical composition, aligning with Elbermawi et al. (2022)'s research.

These results offer significant insight into the bioactive elements present in *G. abyssinica* seed oil, endorsing its prospective application in traditional healthcare practices and as a reservoir of natural substances beneficial for health. This is in agreement with Gorse et al. (2022) research, which emphasizes the medicinal potential of *G. abyssinica* seed oil.

Table 4: Qualitative phytochemical composition of *G. abyssinica* seed oil

Phytochemical	Presence (+)/absence (-)
Saponins	+
Alkaloids	+
Phenol	+
Tannins	-
Flavonoids	-
Glycosides	+

Quinone	-
Cardiac glycosides	+
Steroids	+
Terpenoids	+
Volatile oil	+
Sterol	+
Resin	-
Phlobatanins	-

3.6. Spectroscopic characteristics of seed oil

G. abyssinica oil's spectrophotometric characteristics provides an understanding of its molecular structure, paving the way for its use in various sectors, notably in quality assurance and adulteration detection. The UV-Visible spectrum shown in Figure 2 exhibits a significant adsorption peak at 340 nm (absorbance: 4.4822), likely due to $\pi \rightarrow \pi^*$ electronic transitions (Vogt et al., 2023). This transition, indicative of unsaturated fatty acids in the oil, is common in molecules with conjugated systems, often found in vegetable oils due to their fatty acids with one or more double bonds (Jadhav & Annapure, 2023; Lima et al., 2021). Additionally, the modified absorption at 347 nm in the oil-hexane mixture (Absorbance: 0.7592) (figure 3), which differs to the three peaks (at 256, 260 and 267nm) reported for the methanol solution of *G. abyssinica* seed oil by Nasirullah et al. (1982), forms a distinctive signature for the pure oil. These spectral characteristics can act as a benchmark for identifying potential impurities or adulterants, as any variations in absorption patterns could signify alterations in the oil's concentration or the introduction of foreign substances.

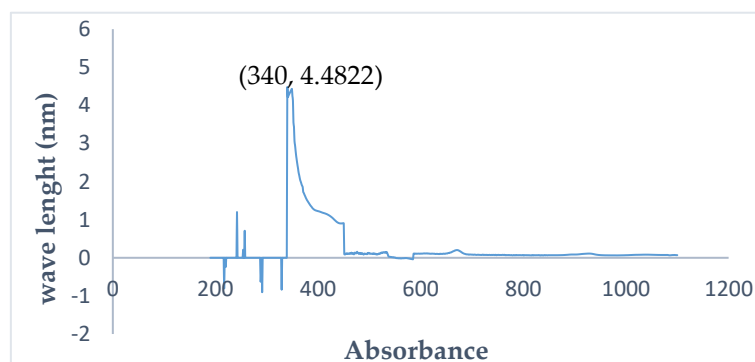


Figure 2: Absorbance spectrum of *G. abyssinica* seed oil in the absence of solvent showing λ_{max} and Absorbance (nm) at λ_{max}

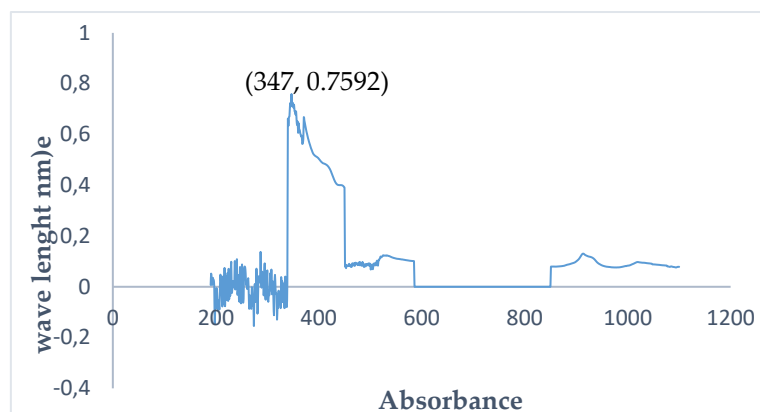


Figure 3: Absorbance spectrum of *G. abyssinica* seed oil-hexane (1 ml: 2 ml) mixture showing λ_{max} and Absorbance (nm) at λ_{max}

The IR spectrum analysis provides insight into the oil's molecular structure by identifying functional groups through their vibrational frequencies (Figure 4). A pronounced peak 1742.59 cm^{-1} signals the presence of carbonyl groups, likely from esters or ketones (Smith, 2018), which are crucial for assessing the oil's quality and longevity. Peaks observed at 2360.35 cm^{-1} and 2852.68 cm^{-1} are indicative of alkyne and alkane groups, respectively (Smith, 2018), adding to the oil's detailed chemical composition. These identified groups align with known constituents of the oil, enhancing its application across various sectors. For instance, carbonyl groups can influence the oil's flavor profile, beneficial for culinary uses, while the presence of alkynes and alkanes contributes to the oil's stability, making it ideal for use in beauty and health products.

Additionally, this spectroscopic information acts as a benchmark for quality assurance, allowing for the quick verification of the oil's authenticity. Deviation from the spectral data could signal contamination or adulterations in the oil's makeup, underscoring the critical role of spectral analysis in ensuring product integrity and effectiveness (Przykaza et al., 2021).

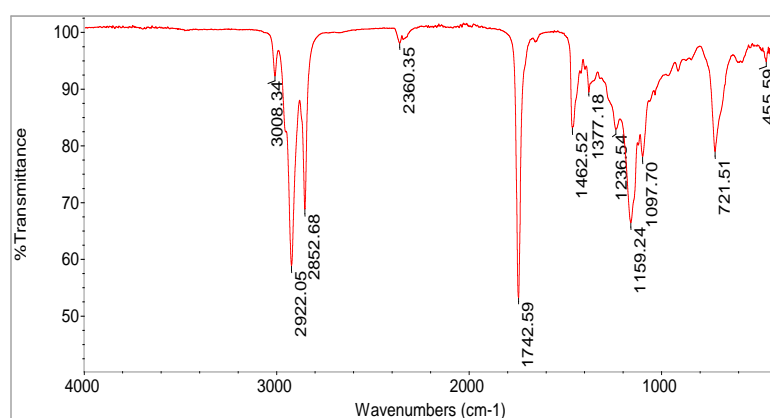


Figure 4: FTIR spectrum of *G. abyssinica* seed oil

3.7. Fatty acid profile of seed oil

The analysis of the fatty acid profile in the oil from *G. abyssinica* seeds was carried out through the process of transesterification. The findings, which are detailed in Table 5 and 6, show the types and concentrations of fatty acids present. Linoleic acid emerged as the dominant fatty acid, constituting 74.608% of the total fatty acid content. This percentage is consistent with the 71.3-77.7% range found

in seeds from the US and Ethiopia (Fatima et al., 2015; Tsehay et al., 2021). However, it exceeds the 51.6-58.4% and 45.4-65.8% ranges reported for Indian seeds by Nasirullah et al. (1982) and Nagaraj, (1990), respectively. The presence of fatty acids like Palmitic acid and Stearic acid adds to the variety of fatty acids identified. Table 6 lists the non-fatty acid components and their normalized composition in the transesterified oil, highlighting components such as Z-8-pentadecen-1-ol acetate, Methyl-E, E-2, 13-octadecadien-1-ol and 5-Eicosene, (E), which contribute to the oil’s chemical diversity.

The aggregate of saturated, monounsaturated, polyunsaturated, and total unsaturated fatty acids is presented, emphasizing the oil’s high content of unsaturated fatty acids, especially polyunsaturated ones, which underscores the health benefits of consuming *G. abyssinica* seed oil. This is in line with a study by Lima et al., 2021, which reported a high polyunsaturated fatty acid content in unconventional Brazilian food plants, and with Odera et al. (2023), who found that *G. abyssinica* seed oil, primarily used for consumption in India, is rich in linoleic acid.

Overall, this comprehensive analysis of the fatty acid composition of *G. abyssinica* seed oil offers valuable insight into its nutritional value and potential uses in the food and pharmaceutical sectors, and further supporting the health advantages of its consumption.

Table 5: Fatty acid composition (% w/w) of *G. abyssinica* seed oil

Concentration (%)	Fatty acid	Common name	Type
0.466	Hexanoic acid	Caproic acid	SFA
3.692	Hexadecanoic acid	Palmitic acid	SFA
74.608	9,12-Octadecadienoic acid (z,z)-	Linoleic acid	PUFA
3.667	Octadecanoic acid	Stearic acid	SFA
3.472	Eicosanoic acid	Arachidic acid	SFA
6.682	11-Hexadecenoic acid, 15-methyl	—	MUFA
1.302	Docosanoic acid	Behenic acid	SFA
1.092	Tetracosanoic acid	Lignoceric acid	SFA
5.019	Trans-2-dodecenedioic acid	Traumatic acid	MUFA
100	Total		
13.691			TSFA
11.701			TMUFA
74.608			TPUFA
86.309			TUFA

Table 6: Non-fatty acid composition (5 w/w) of *G. abyssinica* seed oil

Concentration	Compound
6-Methyl-bicyclo[4.2.0]octan-7-one -	2.666
5-Eicosene, (E)-	9.143
2-Methyl-Z,Z-3,13-octadecadienol -	2.514
12-Methyl-E,E-2,13-octadecadien-1-ol -	21.701
Z-8-Pentadecen-1-ol acetate -	63.976
Total	100

4. Conclusion

The investigation into *G. abyssinica* seeds highlights their rich nutritional value, varied chemical attribute, and multiple uses. Notably, the seeds are rich in polyunsaturated fatty acids, proteins, and vital minerals. The oil derived from these seeds shows beneficial physico-chemical traits and strong antioxidant capability. Additionally, the UV-Visible and IR spectral data serve as important benchmarks for ensuring product quality. The results of this study point to the seeds' potential in enhancing functional foods and industrial applications, as expanding knowledge of lesser known plant species. The research emphasizes the importance of *G. abyssinica* seeds as a multifaceted asset for diverse uses.

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