



Comparative Evaluation of Proximate and Mineral Composition of *Adhatoda vasica* Leaves and *Zingiber officinale* Rhizome

AS Vikhe¹ and PS Vikhe²

¹Department of Analytical Chemistry, Padmashri Vikhe Patil College of Arts, Science and Commerce, Rahata, Ahmednagar, Maharashtra, India

²Department of Botany, Arts, Commerce and Science College, Satral, Rahuri, Ahmednagar, Maharashtra, India

*Correspondence for materials should be addressed to VAS (email: vikhe8anjali@gmail.com)

Abstract

Adhatoda vasica (Adulsa) and *Zingiber officinale* (ginger) are widely used medicinal plants in traditional Indian systems for respiratory, digestive, and anti-inflammatory purposes. This study compares their proximate composition and selected mineral content using standardized analytical methods on 5 g dry powdered samples. Proximate parameters for Adulsa leaves included moisture (3.20%), fat (4.00%), crude fibre (15.85%), and ash (6.38%). Ginger showed moisture (1.196%), fat (4.00%), crude fibre (2.20%), and ash (9.34%). Mineral profiling revealed Adulsa with iron (0.863 g/5 g), sodium (35 ppm), potassium (78 ppm), calcium (39 ppm), and magnesium (0.1161%). Ginger exhibited higher iron (1.5 g/5 g) and magnesium (1.5%), with sodium (40 ppm), potassium (48 ppm), and calcium (30 ppm). The elevated ash in ginger indicates richer overall mineral content, while Adulsa's higher fiber and potassium support its utility in digestive and respiratory formulations. These findings validate traditional uses, aid quality standardization, and highlight both plants as sources of bioavailable macro- and micronutrients for nutraceutical applications.

Keywords: *Adhatoda vasica*; *Zingiber officinale*; proximate analysis; mineral composition; flame photometry; medicinal plants; nutritional profiling

Introduction

Medicinal plants remain integral to healthcare in Ayurveda, Unani, and folk traditions, offering bioactive compounds with therapeutic potential. *Adhatoda vasica* Nees (family Acanthaceae), known as Adulsa or Vasaka, is valued for bronchodilatory, expectorant, and antimicrobial effects attributed to alkaloids like vasicine and vasicinone (Dhuley, 1999; Amin et al., 2013). *Zingiber officinale* Roscoe (family Zingiberaceae), or ginger, is renowned for anti-inflammatory, digestive, and antioxidant properties due to gingerols, shogaols, and essential oils (Sangwan et al., 2012).

Beyond phytochemistry, proximate parameters (moisture, ash, fat, fibre) influence stability, purity, and shelf life, while mineral content (e.g., Fe, Mg, K, Ca, Na) supports metabolic functions and enhances pharmacological activity (Singh and Singh, 2012; Zeiner, 2025). Scientific evaluation of these attributes is essential for standardization, quality control, and bridging traditional knowledge with evidence-based phytotherapy. This comparative study quantifies proximate and selected mineral profiles of Adulsa leaves and ginger rhizome to assess nutritional and therapeutic value.

Materials and Methods

Sample Collection and Preparation

Fresh *Adhatoda vasica* leaves were collected in December 2024 from the Botany Garden, Arts, Commerce and Science College, Satral, Tal: Rahuri, Dist: Ahmednagar, Maharashtra, India. Ginger rhizome samples were obtained locally. Leaves/rhizomes were washed thoroughly with tap water, rinsed with distilled then deionized water, sun-dried for 7 days, and ground to fine powder using an electric grinder. Powders were stored in airtight containers.

For ashing, 5 g powder was placed in a china dish, heated at 105 °C to constant weight for moisture removal, then ignited at 550 °C in a muffle furnace for ~5 h until gray/white ash formed. Ash was cooled in a desiccator, dissolved in 2 mL 6 M HNO₃, heated, filtered (Whatman No. 41), and diluted to 25 mL with distilled water. Solutions were stored in plastic bottles.

Proximate Analysis

Moisture: Gravimetric loss on drying at 105 °C to constant weight (Khan et al., 2015).

Ash: Total ash by incineration at 550 °C (Gupta et al., 2008).

Fat: Solvent extraction with petroleum ether after ethanol pretreatment (Karthikeyan et al., 2016).

Crude fibre: Standard acid-alkali digestion method (not detailed in original but implied).

Mineral Analysis

Na, K and Ca were determined by flame photometry; Fe and Mg by colorimetric methods (NJ, 2021; Subramanian et al., 2023). Concentrations expressed per 5 g sample.

Results and Discussion

Proximate Composition

Table 1 presents proximate parameters on a 5 g dry basis.

Table 1. Proximate composition of *Adhatoda vasica* leaves and *Zingiber officinale* rhizome (per 5 g dry sample)

Parameter	<i>Adhatoda vasica</i> (%)	<i>Zingiber officinale</i> (%)
Moisture	3.20	1.196
Fat	4.00	4.00
Crude fiber	15.85	2.20
Ash	6.38	9.34

Adulsa exhibited higher moisture (3.20%) and crude fiber (15.85%), suggesting better hydration capacity and dietary fibre contribution for digestive health. Ginger showed lower moisture (1.196%), aiding longer shelf life, and markedly higher ash (9.34%), indicating greater inorganic residue and mineral density—consistent with literature reporting ginger ash ~3–9% dry weight (Sangwan et al., 2012; Al Dhaheri et al., 2023). Fat content was identical (4.00%), reflecting moderate lipid profiles in both.

Mineral Composition

Table 2 summarizes key minerals.

Table 2. Mineral composition of *Adhatoda vasica* leaves and *Zingiber officinale* rhizome (per 5 g dry sample)

Mineral	<i>Adhatoda vasica</i>	<i>Zingiber officinale</i>
Iron	0.863 g	1.5 g
Sodium	35 ppm	40 ppm
Potassium	78 ppm	48 ppm
Calcium	39 ppm	30 ppm
Magnesium	0.1161 %	1.5 %

Ginger displayed superior iron (1.5 g/5 g) and magnesium (1.5%), supporting its role in anemia management and enzymatic functions. Adulsa had higher potassium (78 ppm) and calcium (39 ppm), beneficial for cardiovascular and bone health. Sodium levels were comparable. Iron values appear elevated relative to typical dry herb ranges (e.g., ginger Fe ~10–80 mg/100 g; Zeiner, 2025), possibly due to concentrated sample preparation or methodological scaling—further validation recommended. These minerals enhance therapeutic efficacy: Fe/Mg in ginger aid anti-inflammatory effects; K/Ca in Adulsa supports respiratory and metabolic roles.

Conclusion

Adhatoda vasica and *Zingiber officinale* exhibit distinct yet complementary nutritional profiles. Adulsa provides higher fibre and potassium/calcium, ideal for respiratory/digestive support, while ginger excels in iron/magnesium and ash content, reinforcing its anti-inflammatory and metabolic benefits. These data support the standardization of herbal formulations and validate ethnomedicinal applications.

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Author Contributions

VAS and VPS conceived the concept, wrote and approved the manuscript.

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Competing interest

The authors declare no competing interests.

Ethics approval

Not applicable.



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