



Chemical composition and elemental profile of *Artemisia absinthium* from Budgam region of Kashmir.

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Abstract: While studying the aerial part of *Artemisia absinthium* from Budgam region of Kashmir, we have analyzed its chemical composition. Special findings include the presence of organic acids (1.05%) and flavonoids (0.51%) along with moisture (7.13%), total dust (6.36%) and extractives (12.79%). Gray analysis revealed eight macro-micro elements including potassium (417.451 µg/ml), calcium (115.927 µg/ml), magnesium (26.191 µg/ml) and sodium (15.906 µg/ml). Our analytical approach involved multi-element atomic emission spectral analysis at G.D.C Nawakadal and Nit Srinagar Institute.

In addition, we identified twenty amino acids and eight fatty acids in *Artemisia absinthium*. Key amino acids include glutamate (2381 mg/100g), aspartate (1201 mg/100g) and alanine (710 mg/100g). The main fatty acids consist of linoleic acid (45.8%) and oleic acid (29%). These findings provide valuable insight into the bioactive components and elemental composition of *Artemisia absinthium*.

Introduction:

In the broad Composite family, the tribe *Artemisia* is distinguished by more than nine hundred species in about sixty genera. At the head of this botanical kingdom is the genus *Artemisia*, known as wormwood, which has four remarkable facial features [1]. Pharmacopoeias around the world document the importance of *Artemisia* species, with *Artemisia absinthium* occupying a prominent place. This species is popular for its therapeutic properties in the treatment of various inflammatory

conditions such as chronic bronchitis, asthma, gastroenteritis and pruritus [3]. Especially, the aerial part of *Artemisia absinthium* has shown anti-snake venom properties [4].

Artemisia seeds have attracted attention for their various medicinal effects, and anti-inflammatory and anticancer activity has been reported in various species [5].

The main constituents of *Artemisia absinthium*, absinthin, artabsin, and guainolides, contribute to its characterization as a strong bitter, aromatic, anthelmintic, stomachic, antiparasitic, antiseptic, choleric, and carminative medicinal plant. It also exhibits mild anti-inflammatory and antidepressant properties. The medicinal properties of wormwood, especially its aromatic pungency and antimicrobial properties, are derived from pungent compounds and essential oils. In particular, plant oils, when used carefully, can act as heart stimulants to improve blood circulation. It is important to note that although pure wormwood oil is highly toxic in the right dose, it poses minimal or no risk [7].

In the current study, we do the first quantitative and qualitative analysis of the phytochemical components of the medicinal plant *Artemisia absinthium* occurring in the Budgam region of Kashmir and initiate new research efforts.

Materials and methods

Plant Collection:

The aerial part of *Artemisia absinthium* was collected from Najan village in Beerwah tehsil, Budgam in October 2023 By Zulqarnain Ahmad Sheikh. Dr. Ghazanfar Ali and colleagues in G.W.C Nawakadal associated with Kashmir University identified the botanical identity. The collected aerial parts were air-dried, cut into small pieces and stored at room temperature.

Quantitative and Qualitative Analysis

The biologically active constituents were analyzed quantitatively and qualitatively using previously reported methods in a study conducted at NIT Srinagar and G.W.C Nawakadal. The composition of macro-micro elements was determined using multi-element atomic emission spectral analysis in *Artemisia absinthium* ash for elemental determination. The mineral composition of the dust was studied using a state of the art spectrometer at N.I.T Srinagar and Nawakadal College.

Fatty acid content

To determine the acid content, *Artemisia absinthium* was extracted with a mixture of chloroform-methanol (2:1) for 30 minutes. The extract was filtered, concentrated to dryness and methylated at 60-70°C for 30 minutes. Gas Chromatography using CARLO-ERBA-420 instrument at N.I.T Srinagar helps to analyze fatty acid methyl ester.

Amino Acid Composition

Amino acid composition was determined by gas chromatography coupled to mass spectrometry (GS/MS). The analysis consisted of carbowax 20 m, silar 5 CP, and Lexa polar mixture in a WA-W-120-140 mesh column. Chromatograms were calculated against external standards.

Gray and extractable content

The ash content of plant material is estimated by means of a curve showing pollution or timely collection. Mineral matter, which is a combination of organic and inorganic matter, is quantitatively defined as dry matter. This parameter is very important to evaluate the quality of medicinal plant substances based on the content of biological metabolites.

Organic acids and flavonoids

Organic acids, which are important for maintaining the body's acid-base balance, have been studied for their effects on pH levels and nutrient absorption. Flavonoids, powerful plant compounds, have been evaluated for their enzymatic effects, contributing to their antioxidant properties. Their potential therapeutic value, especially in cardiovascular health, is highlighted by the proven scientific association between the consumption of flavonoids and reduced cardiovascular disease mortality.

Results

Quantitative and qualitative analysis:

In our work, we focus on biologically active components in the aerial parts of *Artemisia absinthium*, focusing on key parameters such as moisture content, total ash and extractives. Our approach includes extensive quantitative analysis to accurately identify these elements and qualitative research to understand the nature and composition of important plant components. This dual analytical strategy reveals the nuanced nature of *Artemisia absinthium* which provides valuable insight into its botanical profile.

The results are shown in table 1.

Figure 1. This is a figure. Schemes follow the same formatting.

Table 1. Quantitative analysis of bioactive constituents of aerial part of *Artemisia absinthium*

Moisture content	Ash	Flavonoids	Organic Acids	Extractives
7.13%	6.36%	0.51%	1.07%	12.79%

Composition of macro-micro elements

Our study examines the complex composition of macro-micronutrients present in the ashes of *Artemisia Absinthium*. A total of eight elements were identified and their details are documented in Table 2, showing the relationship between these important components. This detailed analysis improves our understanding of the elemental composition of *Artemisia absinthium* and adds valuable information to better understand its botanical properties.

Table 2 _Composition of macro-micro elements in the ash of Plant *Artemisia absinthium*

Element	K	Mg	Ca	Mn	Fe	Zn	Cu	Na
µg/ml	417.451	26.191	115.927	0.325	4.526	5.234	0.146	15.906

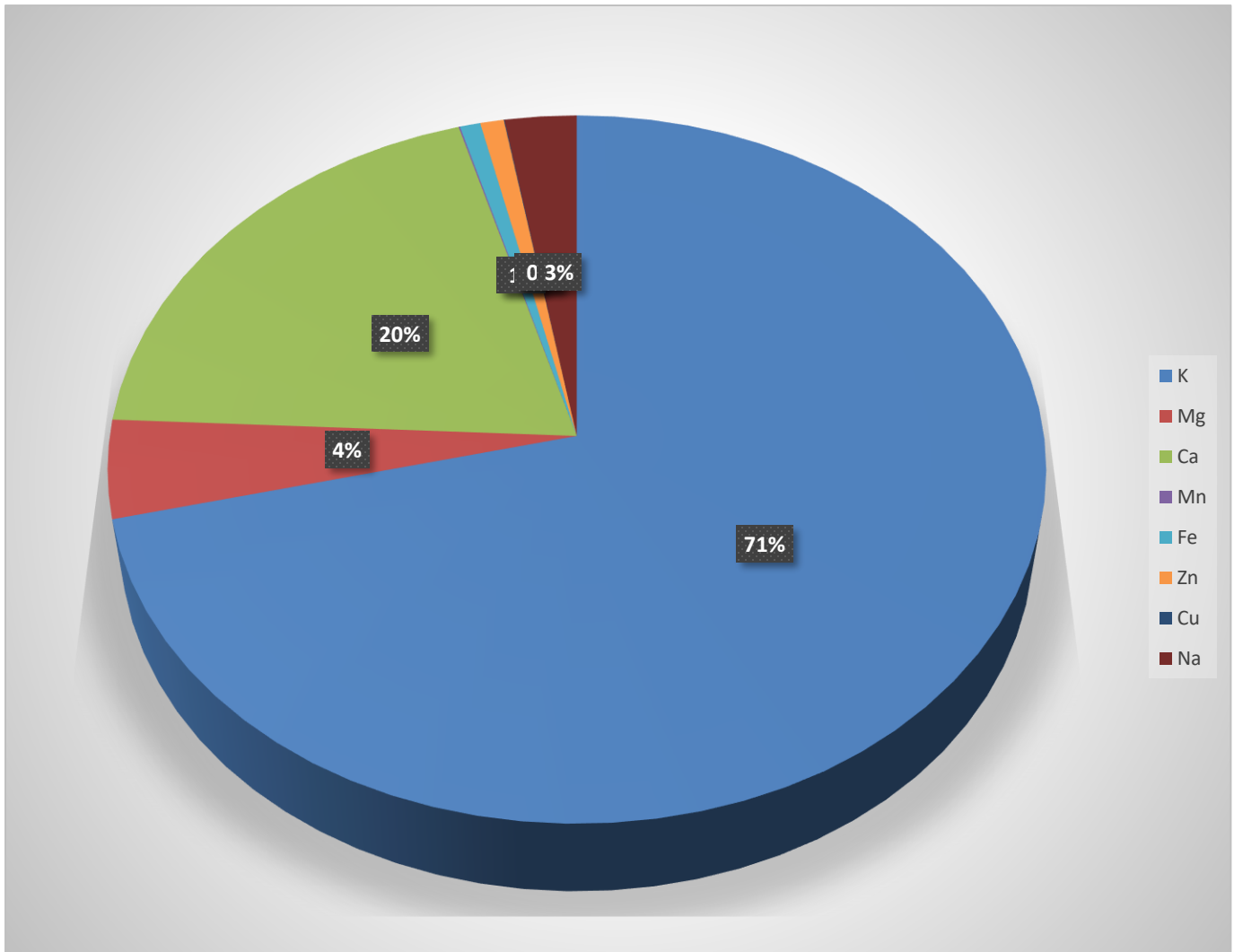


Figure 1 – Percentage contents of macro- and micro elements in ash of *Artemisia absinthium*

Important role of trace elements:

Trace elements play an important role in supporting normal life functions for living organisms. Not getting enough potassium can damage the function of the heart and skeletal muscles, which can lead to severe neuropathy. Long-term deficiencies of calcium and vitamin D increase the risk of osteoporosis and can lead to rickets in children. Iron, an important micronutrient, catalyzes oxygen metabolism and is mainly stored in the globular protein complex ferrite. Iron deficiency manifests as chlorosis in plants and anemia in animals.

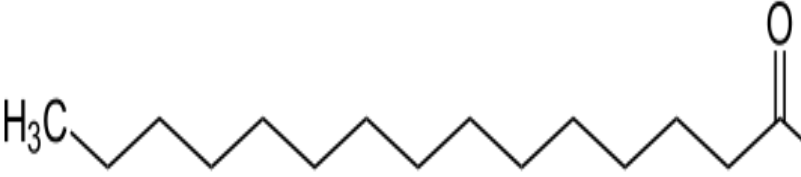

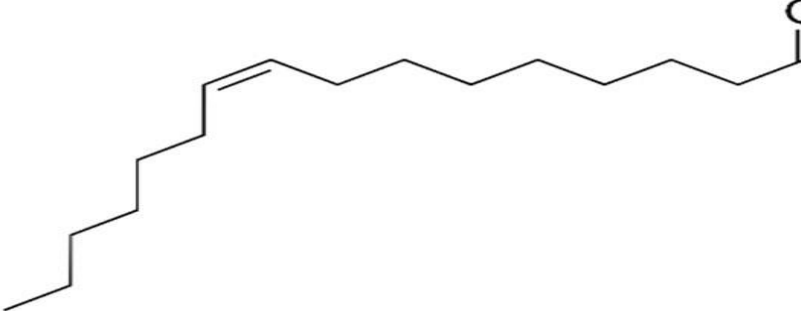


Zinc is essential for sperm production, male hormones, vitamin E metabolism, normal prostate function, anabolic hormone synthesis (insulin, testosterone, and growth hormone) and the breakdown of alcohol by alcohol dehydrogenase. Magnesium is important for the proper functioning of the nervous system and the heart muscle providing additional benefits such as vasodilation,

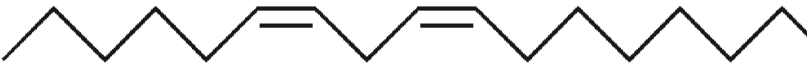


stimulation of bile secretion and increased bowel motility, and aiding in the elimination of cholesterol.

Fatty acid composition

Absinthium has a high fatty acid profile with linoleic acid (44.8%) and oleic acid (30%) as the main constituents. These fatty acids contribute to the overall composition of the plant, providing insight into potential health benefits and nutritional value.



№	Fatty acids	Molecular formula	Structure	M W	Amount in plant, %
1	Pentadecanoic acid C _{15:0}	C ₁₅ H ₃₀ O ₂		242	2.1
2	Palmitic acid C _{16:0}	C ₁₆ H ₃₂ O ₂		256	14.3
3	Palmitoleic acid C _{16:1}	C ₁₆ H ₃₀ O ₂		254	1.2
4	Stearic acid C _{18:0}	C ₁₈ H ₃₆ O ₂		284	4.6
5	Oleic acid C _{18:1}	C ₁₈ H ₃₄ O ₂		282	30

6	Linoleic acid $C_{18:2}$	$C_{18}H_{32}O$ 2		280	44.8
7	Linolenic acid $C_{18:3}$	$C_{18}H_{30}O$ 2	 Linolenic acid	278	0.7
8	Meristic acid $C_{14:0}$	$C_{14}H_{28}O$ 2		228	2.3

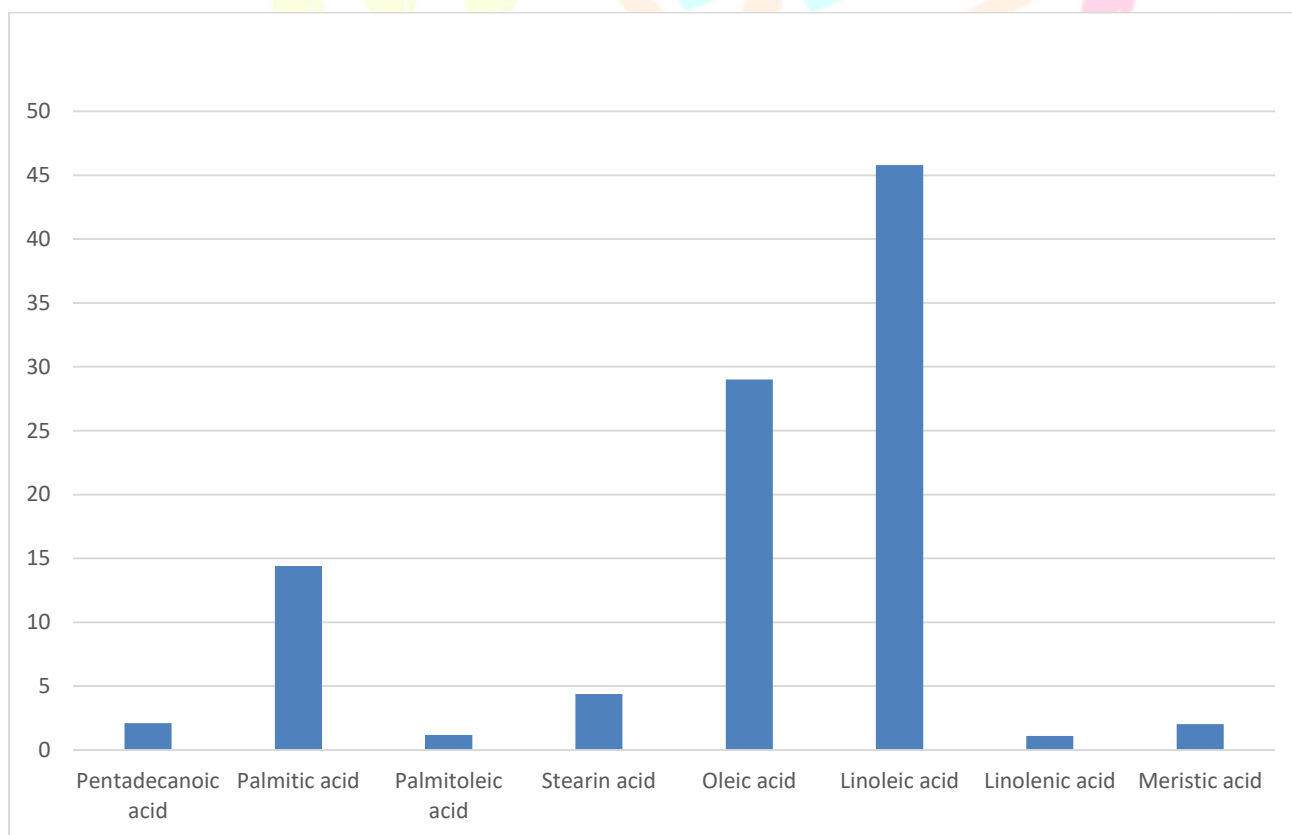


Figure 3 Fatty acid contents of *Artemisia absinthium*

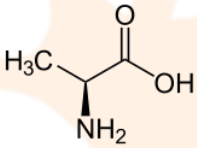
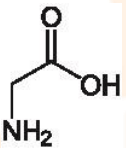
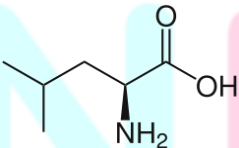
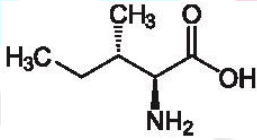
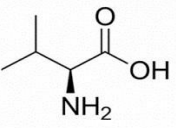
Fatty acid composition

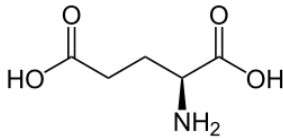
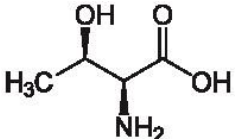
The major fatty acids which is contained in *Artemisia absinthium* were linoleic acid (44.8%) and Oleic acid (30%). Recent studies have sparked interest in the valuable properties of linoleic acid.

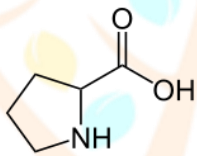
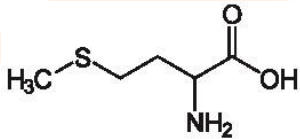
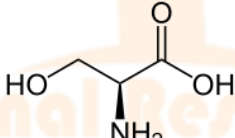
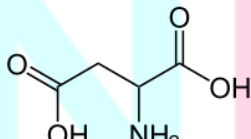
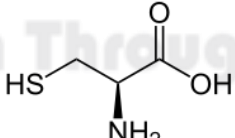
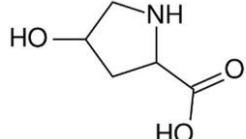
This compound has been linked to numerous health benefits such as decreasing the risk of cancer, heart disease, and other inflammatory conditions. Additionally, it has been found to aid in promoting growth and strengthening bones. On the other hand, oleic acid has been shown to possess neuro protective qualities, potentially protecting the brain and adrenal glands from disease. It has also been associated with improved memory function and lower blood pressure. However, careful consideration is necessary as there is research suggesting that oleic acid may be connected to the development of specific cancers, namely breast cancer.

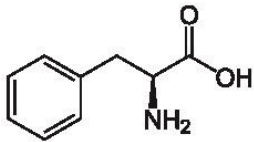
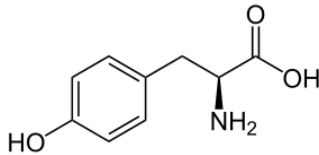
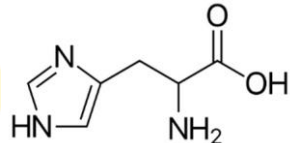
Amino acid composition

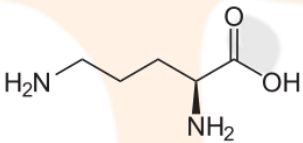

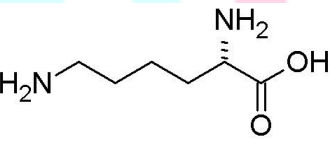
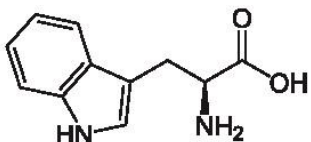
In the amino acid composition analysis, main materials were found to be glutamate (2380 mg/100g), aspartate (12 mg/100g), and alanine (712 mg/100g). Glutamate, categorized as a nonessential amino acid, emerged as a crucial bioenergetic substrate for both regular and neoplastic cellular proliferation. It also serves as an excitatory neurotransmitter, actively collaborating in numerous biosynthetic, bioenergetic, metabolic, and oncogenic signaling pathways [11].

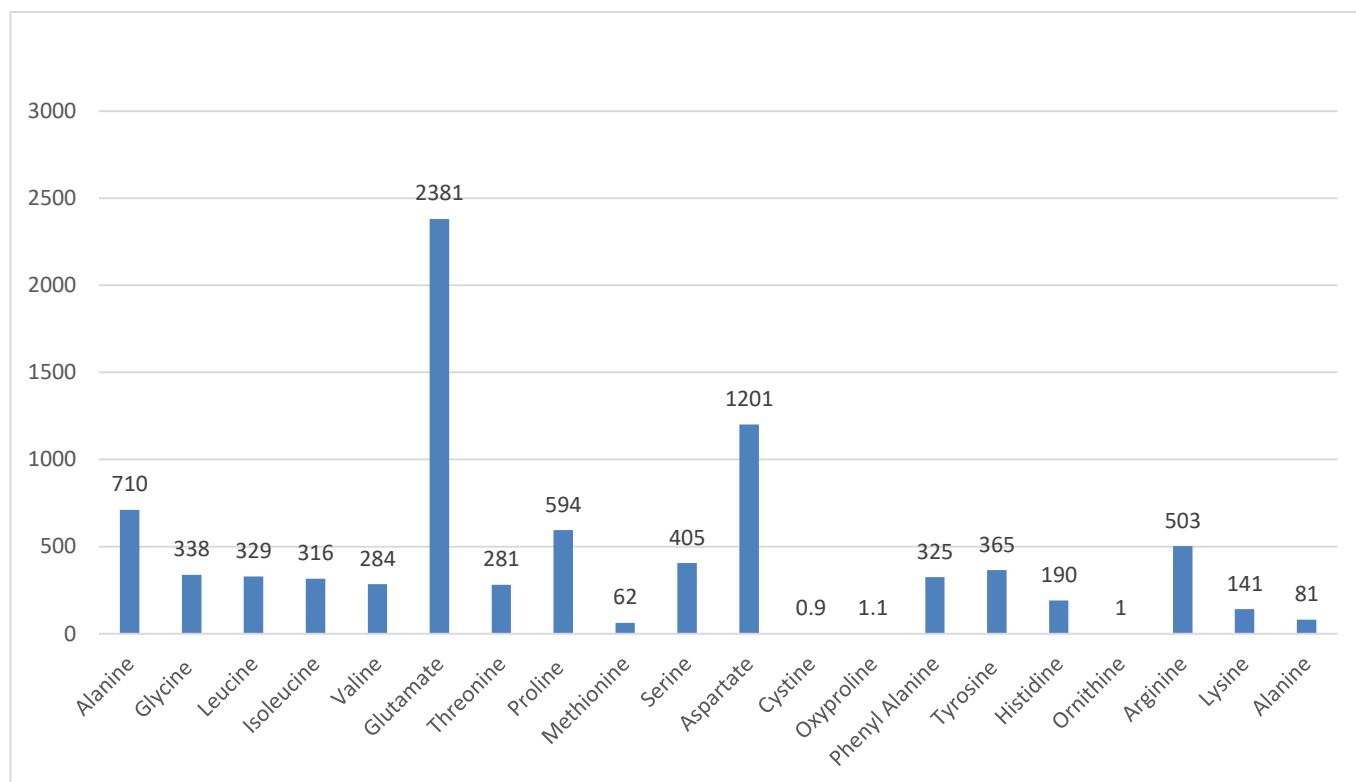
No	Amino acids	Molecular formula	Structure	MW	Amount in plant, mg/100g
1	Alanine	C ₃ H ₇ NO ₂		89	710
2	Glycine	C ₂ H ₅ NO ₂		75	338
3	Leucine	C ₆ H ₁₃ NO ₂		131	329
4	Isoleucine	C ₆ H ₁₃ NO ₂		131	316
5	Valine	C ₅ H ₁₁ NO ₂		117	284

6	Glutamate	$C_5H_9NO_4$		147	2381
7	Threonine	$C_4H_9NO_3$		119	281

No	Amino acids	Molecular formula	Structure	MW	Amount in plant, mg/100g
8	Proline	$C_5H_9NO_2$		115	594
9	Methionine	$C_5H_{11}NO_2S$		149	62
10	Serine	$C_3H_7NO_3$		105	405
11	Aspartate	$C_4H_7NO_4$		133	1201
12	Cysteine	$C_3H_7NO_2S$		121	0.9
13	Oxyproline	$C_5H_9NO_3$		131	1.1

14	Phenylalanine	$C_9H_{11}NO_2$		165	325
15	Tyrosine	$C_9H_{11}NO_3$		181	365
16	Histidine	$C_6H_9N_3O_2$		155	190

No	Amino acids	Molecular formula	Structure	MW	Amount in plant, mg/100g
17	Ornithine	$C_5H_{12}N_2O_2$		132	1
18	Arginine	$C_6H_{14}N_4O_2$		174	503
19	Lysine	$C_6H_{14}N_2O_2$		146	141
20	Tryptophan	$C_{11}H_{12}N_2O_2$		204	81



Aspartic acid, diagnosed for its immune-boosting houses, metabolic have an effect on, and capacity to deactivate ammonia, changed into stated for its involvement in ribonucleic acid formation. Additionally, studies underscored its efficacy in raising testosterone ranges, making it a precious complement for bodybuilding athletes in search of enhanced power, elevated libido, and elevated testosterone in the bloodstream [12].

Alanine, with its pivotal role in metabolic strategies, changed into diagnosed as a regulator of blood sugar degrees. Notably, this amino acid proven shielding consequences in opposition to pancreatic and prostate cancer improvement. Widely acknowledged in sports activities nutrition, alanine was observed to growth physical persistence and facilitate muscle groups development [13]. These findings light up the multifaceted roles of glutamate, aspartate, and alanine, organising their importance in physiological tactics and ability packages in various health-associated domain names.

Conclusion

In conclusion, this observe encompassed a complete evaluation of *Artemisia Absinthium*, investigating each quantitative and qualitative components of its bioactive components. The examination included exams of moisture content, overall ash, and extractives, revealing tricky details about the plant's composition. Additionally, macro-micro elements within the ash have been scrutinized, identifying a complete of eight factors via multi-element atomic emission spectral analysis.

Furthermore, the amino acid profile of *Artemisia Absinthium* exhibited brilliant concentrations of glutamate (2381 mg/100g), aspartate (1201 mg/100g), and alanine (710 mg/100g), whilst the fatty acid composition changed into ruled by linoleic (45.8%) and oleic (29%) acids.

Artemisia absinthium showcased various medicinal homes, with highlighted advantages including its efficacy in preventing cancer cells, disposing of parasites, and treating conditions together with Crohn's disorder and Small Intestinal Bacterial Overgrowth (SIBO). The plant additionally confirmed antimicrobial and antifungal capabilities. Notably, the extract absinthian, derived from wormwood, emerged as a amazing antimalarial compound, leading to its development as a pharmaceutical drug with sizeable efficacy. These findings underscore the multifaceted therapeutic potential of ARTEMISIA Absinthium, imparting precious insights for in addition exploration and utilization in the discipline of medicinal chemistry.

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ABBREVIATIONS

ME-AESA, HPLC, GC, LA, OA, GC-MS, SIBO.

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BRIEFS

Investigating the particular chemical composition of *Artemisia absinthium* in Budgam, this take a look at unveils precious insights into the plant's elemental profile, contributing to our expertise of its ecological significance

SYNOPSIS

This research delves into the complicated chemical make-up and elemental characteristics of Artemisia absinthium from the Budgam vicinity in Kashmir, dropping mild on its environmental implications and potential packages.

