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Burning nettle (*Urtica urens L.*) from the flora of Palestine: phytochemical analysis and amino acid profile in Leaves

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Abstract:

This study aims to provide data on the chemical composition of Burning nettle leaves (*Urtica urens L.*), native to Palestine, belonging to the family Urticaceae. The plant leaves were extracted with water, ethanol, chloroform, and hexane, and analyzed to detect various active compounds. The results of phytochemical analysis showed that nettle leaves contain a full range of active chemical compounds in all extracts, such as flavonoids, carbohydrates, tannins, alkaloids, proteins , amino acids, terpenoids, tri-terpenoids, coumarins, saponin and Phenolic compounds . For the first time in Palestine as a result of the Phytochemical analysis a group of amino acids were identified in the leaves of the plant such as valine, aspartic acid, tryptophan, glutamic acid, phenylalanine, asparagine, leucine, glycine, lysine, arginine, alanine, tyrosine, cysteine.

Index Terms: Phytochemical analysis, Burning nettle, *Urtica urens L.*, Amino acids, flora of Palestine.

Introduction

Burning nettle (*Urtica urens L.*) (alqaras in Arabic) is a perennial medicinal herbaceous plant from the Urticaceae family, used in traditional folk medicine in many countries for its medicinal properties (1)(2).

This plant is widely distributed, and several names are used to identify it, such as common nettle, nettle leaf, or stinging blackberry. The common term "nettle" is taken from the Anglo-Saxon word "noedl," meaning "needle."(3)

The genus name Urtica is derived from the Latin verb urere, meaning "to burn", as the stinging hairs scattered throughout the plant are its distinguishing feature (4).

Skin contact with parts of the plant, especially the leaves, results in a mild, painful sting and itching. The area may become numb for a period ranging from minutes to days. In some cases, the infection develops into red spots(5).

The many plant species has been used in prehistoric times in various fields, as it has anti-anemia properties, anti-diabetic effects, diuretic effects, immune activation, antioxidant effects, antimicrobial and antiviral properties, anti-cardiovascular effects, and is used as a pain reliever, anti-allergy and anti-inflammatory, especially for arthritis and prostatitis (1)(6).

Nettle leaves are used in traditional folk medicine to treat eczema, digestive disorders, sexual disorders, gout, hair loss, high blood pressure, and hay fever. They are also used as a cleansing tonic, blood purifier, anti-asthma, antiseptic, astringent, and anti-dandruff (7).

Chemical and analytical studies of nettle leaves have shown that they contain a wide range of active substances such as alkaloids, terpenoids, phenols, , tannins, and flavonoids, which have potential as therapeutic agents (1)(3)(8)(9).

Recent studies and research have highlighted the antibacterial, antiviral, antifungal, antioxidant, and anti-inflammatory properties of *Urtica urens L.*, due to its chemical and pharmacological properties and its use as an herbal remedy in traditional and folk medicine for various diseases, which calls for more attention(1).

In Palestine, this plant grows naturally and is found in mountains, roads, fields, and wild forests(7). Figure-1

The aim of this research study, which is the first of its kind, is to identify the chemical composition and types of amino acids accumulated in Burning nettle (*Urtica urens L.*) leaves.

Fig.1 Burning nettle (*Urtica urens L.)*

MATERIALS AND METHODS

Plant collection: *Urtica urens L.* leaves were collected from April to May 2025 from Ezbet Shofa village (32°17'14"N, 35°2'33"E), Tulkarm city, West Bank - Palestine. *Urtica urens L.* this plant was identified botanically by Dr. Rami Al-Qaisi from National Agricultural Research Center – MOA.

leaves were cleaned with tap water, then leaves were washed with distilled water and air-dried in a dark place for three weeks. The leaves were then ground into a powder using a mill and stored in opaque plastic containers until ready to use.

Preparation of *Urtica urens L.* leaves extracts: Nettle leaves extracts were prepared by sequential extraction method using a variety of solvents (water, ethanol, chloroform, and n-hexane).The ratio of leaves powder to extract liquid was (1-10) and then in a Soxhlet apparatus, for 10 hours at a temperature of 90°C. The extracted material was then collected in a separate conical flask for each liquid, and concentrated under low pressure and low temperature using a rotary evaporator.

Preliminary phytochemical screening Urtica urens L. leaves extracts

Phytochemical analysis was performed on aqueous, ethanol, chloroform, and hexane extracts obtained from nettle leaves using standard methods are described in references (10)(11)(12). Various extracts were examined for alkaloids, tannins, saponins, steroids, flavonoids, coumarins, phenols, terpenoids, anthraquinones, carbohydrates, and proteins.

Amino acid analysis

Amino acids were detected in nettle leaves using a qualitative analysis method following the methodology described by Khaled Abu Thaher-2024 (13).

RESULTS

The phytochemical analysis of nettle leaves extracts is shown in Table. 1. The leaves extract was found to contain flavonoids, carbohydrates, tannins, alkaloids, amino acids, terpenoids, tri-terpenoids, , phenolic, and coumarins.

Table. 2. shows the specific amino acid content of the nettle leaves extracts. The leaves extract was found to contain valine, aspartic acid, tryptophan, glutamic acid, phenylalanine, asparagine, leucine, glycine, lysine, arginine, alanine, tyrosine, cystein.

DISCUSSION

Nettle is a medicinal herb known for its diverse applications in treating inflammation, allergies, diabetes, and urinary tract disorders in traditional medicine. However, it should be noted that the phytochemical composition of nettle leaves can vary considerably due to geographical differences and environmental factors that affect plant growth and quality (1).

Therefore, studying and exploring the chemical properties of nettle leaves from different regions and countries is essential. In this study, we conducted a comprehensive evaluation of nettle leaves found in the West Bank of Palestine, and to the researcher's knowledge, no previous research on this topic (amino acids in leaves *Urtica urens L.*) has been documented in scientific literature.

The chemical analysis included a phytochemical examination of the active ingredients and amino acids. To ensure a comprehensive understanding, we compared our findings with previous studies that investigated the phytochemical composition of nettle species from various regions and countries.

Nettle leaves contain a variety of biochemicals that have physiological and biochemical effects in the human body. These biologically active components include flavonoids, carbohydrates, saponin, tannins, alkaloids, proteins and amino acids, terpenoids, triterpenoids, coumarins, and phenolic compounds.Table.1.

Our current study, which investigated the active compounds in nettle leaves, showed good agreement with the results of other studies (1) (2)(3)(14).

Phytochemical analysis of the leaves revealed that flavonoids, tannins, saponins, and polyphenols were abundant in extracts of water, ethanol, chloroform, and hexane. Alkaloids and coumarins were not present in the ethanol and hexane extracts. Meanwhile, proteins and amino acids were present in the water, ethanol, and chloroform extracts but not in the hexane extract. The study also showed that anthraquinones were not present in all extracts, while terpenoids and triterpenoids were present in water, ethanol, and hexane extracts but not in chloroform.

Table.1. The phytochemical analysis of Burning nettle leaves (*Urtica urens L.)* extracts

N.	Phytochemicals	Test	Extract	Result
1	Triterpenoids	Libermann-Burchard reaction	Water ethanol n-hexane	+ + +
2	Anthraquinones	Borntrager's reaction	Water ethanol chloroform n-hexane	- - - -
3	Flavonoids	Shibata's reaction (Shinoda reaction)	water ethanol chloroform n-hexane	+ + + +
4	Tannins	Ferric chloride reaction	water ethanol chloroform n-hexane	+ + + +
5	Coumarins	With 10% solution NaOH	water chloroform	+ +
6	Amino acids	Biuretreaction Ninhydrin reaction	Water ethanol chloroform	+ + +
7	Alkaloids	Dragendorff‟s reaction , Wagner‟s reaction, Hager's reaction	water chloroform	+ +
8	Phenols	Lead acetate reaction	water ethanol chloroform n-hexane	+ + + +
9	Saponin	Foam (Froth) Test	water ethanol chloroform n-hexane	+ + + +
10	Terpenoids	Libermann-Burchard test Salkowski's test	Water ethanol n-hexane	+ + +
11	Carbohydrate	Molisch's test	Water ethanol chloroform n-hexane	+ + + +

In recent years, scientists and researchers have paid great attention to natural products from plants due to their diverse therapeutic and pharmacological properties, including their antioxidant and antitumor activity. The most important of these biologically active compounds in plants are alkaloids, flavonoids, tannins, and phenolic compounds. These compounds possess diverse biological properties and enable plants to address various environmental challenges. Many plants have been shown to possess effective antioxidant properties thanks to their phenolic components (15)(16).

The results of the current research and other research have proven the presence of several active substances in the leaves of the nettle plant, which indicates its future importance in modern medicine(16)(17).

To detect the presence of amino acids in nettle leaves, phytochemical analysis was performed using one-dimensional paper chromatography or thin-layer chromatography (TLC) in different systems:

A- n-butanol - acetic acid - water (4:1:2)

B- ethanol - toluene (2:1)

The chromatographs were then dried, treated with a 0.2% alcoholic ninhydrin solution, and placed in a drying chamber for 5 minutes at a temperature between 100 and 1050C. Red, reddish-purple, and brown spots appeared, indicating the presence of amino acids, as shown in the results of the chromatographic studies in Table 2.

As a result of phytochemical examination (qualitative analysis – chromatographic techniques) and comparison with reference samples, thirteen free amino acids were found in nettle leaves.

The current study showed that the leaves of the studied plant contain a wide variety of amino acids : valine, aspartic acid, tryptophan, glutamic acid, phenylalanine, asparagine, leucine, glycine, lysine, arginine, alanine, tyrosine, cysteine. Tabl.2.

Amino acids are of great importance to plants, as they play a key role in various physiological processes, such as the synthesis of phenolic compounds. In addition, pharmaceutical products and nutritional supplements made from medicinal plants provide a rich source of both essential and non-essential amino acids.

Table. 2. The qualitative composition of amino acids in the leaves of Burning nettle (*Urtica urens L.)*

No.	Amino acid	General formula	R_f values In mobile phase	
			A	B
1	Aspartic acid	$C_4H_7O_4N$	0.16	0.04
2	Alanine	$C_4H_8O_3N_2$	0.21	0.30
3	Arginine	$C_6H_{14}O_2N_4$	0.05	0.24
4	Glutamic acid	$C_5H_9O_2N$	0.18	0.15
5	Glycine	$C_2H_5O_2N$	0.23	0.14
6	Leucine	$C_6H_{13}O_2N$	0.65	0.63
7	Lysine	$C_6H_{14}O_2N_2$	0.04	0.11
8	Phenylalanine	$C_9H_{11}O_2N$	0.33	0.53
9	Tyrosine	$C_9H_{11}O_3N$	0.55	0.37
10	Valine	$C_5H_{11}O_2N$	0.44	0.61
11	Tryptophan	$C_{11}H_{12}N_2O_2$	0.57	0.27
12	Asparagine	$C_4H_8N_2O_3$	0.32	0.07
13	Cystein	$C_6H_{12}N_2O_4S_2$	0.20	0.03

***A-** n-butanol - acetic acid - water (4:1:2)- **B-** ethanol - toluene (2:1)*

CONCLUSIONS

The results of the current study showed that leaves extracts of Burning nettle (*Urtica urens L.)* contain biologically active components such as flavonoids, carbohydrates, tannins, alkaloids, proteins , amino acids, terpenoids, tri-terpenoids, coumarins, saponin and Phenolic compounds , which possess a wide range of pharmacological properties.

The extracts of the leaves of Burning nettle (*Urtica urens L.)* were found to contain a variety of essential and non-essential amino acids: valine, aspartic acid, tryptophan, glutamic acid, phenylalanine, asparagine, leucine, glycine, lysine, arginine, alanine, tyrosine, cystein.

The results of the current study indicate the need for more intensive research on the parts of the plant, due to its containing a large group of active substances that have different medicinal effects and due to the potential use of its leaves in treating diseases caused by free radicals, such as diabetes and cancer.

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نبات القراص (Urtica urens L.) من نباتات فلسطين: التحليل الكيميائي النباتي وتركيب الأحماض الأمينية في الأوراق

د. خالد طه محمد أبو طاهر

تهدف هذه الدراسة إلى توفير بيانات حول التركيب الكيميائي لأوراق نبات القراص(Urtica urens L.) ، وهو نبات موطنه فلسطين، وينتمي إلى الفصيلة القراصية (Urticaceae).تم استخلاص أوراق النبات بالماء والإيثانول والكلوروفورم والهكسان، ثم تم تحليلها للكشف عن مختلف المركبات الفعالة. أظهرت نتائج التحليل الكيميائي النباتي أن أوراق القراص تحتوي على مجموعة كاملة من المركبات الكيميائية الفعالة في جميع المستخلصات، مثل الفلافونويدات والكربوهيدرات والتانينات والقلويدات والبروتينات والأحماض الأمينية والتربينويدات والتربينويدات الثلاثية والكومارين والصابونين والمركبات الفينولية. لأول مرة في فلسطين، ونتيجة للتحليل الكيميائي النباتي، تم تحديد مجموعة من الأحماض الأمينية في أوراق النبات مثل الفالين، وحمض الأسبارتيك، والتريبتوفان، وحمض الجلوتاميك، والفينيل ألانين، والأسباراجين، والليوسين، والجليسين، والليسين، والأرجينين، والألانين، والتيروسين، والسيستين.