Trop J Phytochem Pharm Sci, February 2025; 4(2): 55 - 62 **ISSN 2955-1226 (Print)**
ISSN 2955-123(Electronic)

Tropical Journal of Phytochemistry & Pharmaceutical Sciences

Available online at https://www.tjpps.org

Original Research Article

Antioxidant viability and biological activities of compounds identified from ethanol extract of *Uvaria chamae* (Bush Banana) leaves

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ABSTRACT

Uvaria chamae is an endangered plant species found in sub-Saharan Africa that serves as food, foliage, and an alternative source of medicine in striving nations. The current study researched *in-vitro* antioxidant activities, anti-inflammatory potentials and identification of biologically active compounds in ethanol extract of *Uvaria chamae* leaves using standard procedure and methods. Antioxidant and anti-inflammatory activities were evaluated using; Nitric oxide (NO) and 2, 2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activities, ferric reducing antioxidant power (FRAP), total antioxidant capacity (TOAC), membrane stabilization, albumin denaturing test, and antiproteinase inhibition while biologically active compounds were identified in a Gas chromatography-mass spectrometry (GC–MS) analysis. Phytochemistry findings revealed the presence of phenol, flavonoids, alkaloids, terpenes, tannins, saponins, cardiac glycosides, and steroids. Quantitively, phenol had a concentration of 0.78±0.01 mg/g GAE, alkaloid and tannin had a concentration of 0.81±0.00 mg/g ATE and 0.62±0.02 mg/g TAE, respectively. Flavonoids recorded the highest concentration of 1.28 mg/g CAE. In-vitro antioxidant and anti-inflammatory activities of the extract increased significantly ($p<0.05$) with concentration in increasing order. Respective IC_{50} values of the extract attained lower values ($p<0.05$) compared to standard activities. GC-MS analysis of the ethanol leave extract revealed bioactive compounds and their derivatives with vast biological activities ranging neuroprotection, neuropsychotropic antioxidants, and anti-inflammatory. The plant is a resource for further investigation, to explore its potential for neuroprotection and neuropsychiatric agents, a function different from its folkloric usage in the management of various ailments.
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Keywords: *Uvaria chamae*, Antioxidant, Anti-inflammatory, Psychotropic, Neuroprotection, Phenol

Received 23 September 2024
Revised 24 October 2024
Accepted 17 January2025
Published online 01 March 2025

Introduction

In phytostudies, the biological relevance of compounds found in plants is a primary focus. It has a basic influence on scientific assessment and research to find novel bioactive compounds that are beneficial to human health.[1] The search for plant bioactive compounds and the daily investigation of unidentified ingredients of medicinal plants through their manifested anti-inflammatory and antioxidant properties have garnered significant attention worldwide in recent years. The Annonaceae is a sizable family of shrubby aromatic plants that includes 112 genera and approximately 2,150 species[1] and can reach heights of 3.6 to 4.5 meters. The climbing plant, *Uvaria chamae*, also called "finger root," is found in the tropical forest of west and central Africa, along with coastal scrubland amongst other medicinal plants such as *Alchornea cordifolia*, Thalia (Maranthaceae), *Dracaena arborea*, Cyrtosperma, *Anthocleista vogeliana*, ferns, *Mussa endaiserteana, Mitragyna stipulosa*, and Cyclosaurus.[1]

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Citation: Kweki GR, Asagba SO, Kadiri HE. Antioxidant viability and biological activities of compounds identified from ethanol extract of *Uvaria chamae* (Bush Banana) leaves. Trop J Phytochem Pharm. Sci. 2025; 4 (2) 55 – 62 http://www.doi.org/10.26538/tjpps/v4i2.4

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The fruit carpels are arranged in finger-like clusters, and because of this shape, the fruit is known by several colloquial names that can be translated as "bush banana" or similar terms that imply wildness, such as Ayiloko in Igala, Kaskaifi in Hausa, Okooja in Yoruba, Akotompo in Ghana[2] and Ebe-akpata in the Urhobo dialect[4]. When ripe, the fruits are yellow and have a delicious pulp that is commonly consumed.[3] Several forms of traditional medicine employ the roots, bark, and stem of *Uveria Chamae* as a source of medicine.[6,61] Literature has it that phenolic compounds such as flavonoids, steroids, quinones, and sesquiterpenes, were the main active ingredients in the stem, fruits, and leaves that gear its numerous vitalities in folk medicine, especially in issues of anti-inflammatory, microbial infection, antimalarial and analgesic, jaundice,[7] among other local applications. Also, the root is notably effective in the management of febrifuge, purgative, stomachic, and vermifuge.[8] Studies have shown that *U.chamae* bark possesses anticonvulsant, anti-snake venom, anti-inflammatory, uterine contraction, antimalarial, antitrypanosomal, and antioxidant activities.[9,7] Despite the renowned uses of *U. chamae* in folklore treatments amongst rural dwellers as alternative medicine in developing countries, there is an existing lag of information on the bioactive compounds of the leaves, identified from ethanol extraction of *U.chamae* that mediate the anti-inflammatory, anti-tumour and antioxidant processes. In addition to these antioxidant potential, *Uvaria chamae* root and stem has been shown to exhibit other biological activities, including immunomodulatory effects. The presence of phytochemicals such as alkaloids, tannins, and saponins has been linked to these therapeutic properties, indicating that *Uvaria chamae* could play a role in enhancing immune responses and combating pathogenic microorganisms[2] The exploration of these biological activities is crucial for understanding the full therapeutic potential of Uvaria chamae and its constituents. This study aims to evaluate the antioxidant viability and biological activities of compounds identified from the ethanol extract

of *Uvaria chamae* leaves. By employing standardized assays to assess antioxidant capacity, anti-inflammatory capacity and to record the biological potentials of bioactive compounds found using GC-MS analysis that contributes to the growing body of evidence supporting the use of Uvaria chamae as a functional food and a potential source of natural therapeutic agents for oxidative damage, which is implicated in numerous chronic diseases, including cancer, cardiovascular disorders, and neurodegenerative conditions.

Material and Method

Chemicals
2,2-diphenyl-1-picrylhydrazyl (DPPH), gallic acid, quercetin, and butylated hydroxytoluene were purchased from Sigma Aldrich chemical company (St. Louis, MO, USA). Ethanol from British Drug House (BDH). Every other chemical used for the study was of analytical grade purchased from Fisher Scientific (UK). The GC-MS-grade solvents, i.e. methanol, acetonitrile, and acetic acid, were also analytical standards purchased from Sigma Aldrich chemical company.
Collection and identification of plant samples
Fresh *Uvaria chamae* leaves were collected from the Urhovie Abraka forest in L.G.A., Delta State, Nigeria (Latitude: 5° 47' 21.9552" N, Longitude: 6° 6' 8.4492" E). The specimen was authenticated with a voucher UBH-U353 allocated, and deposited in the herbarium, Department of Plant Science and Biotechnology at the University of Benin, Benin City.

Preparation of plant material and extracts
The Fresh leaves of *Uvara chamae* were washed with distilled water to remove debris and air-dried for two weeks, till a constant weight was obtained. The dried leaves were ground to powder using a manual grinder. 100 g of coarsely powdered leaves was extracted with 400 mL (70% v/v) of ethanol using cold maceration for 72 hours. The extract was filtered through cheesecloth with fine pores, and the filtrate obtained was filtered for the second time using Whatman No. 1 filter paper. The resulting extracts were concentrated to yield a dark brown mass using a rotary evaporator RII – HB (Buchi labortechnikb AG Switerzland CH-9230) at 50℃ and then stored in the refrigerator for further study.

Preliminary Phytochemical screening
Preliminary phytochemical screening of the leaf extracts of *Uvaria chamae* was carried out as described by[10] and [11] to investigate for the presence of secondary metabolites such as saponins, cardiac glycosides, tannins, flavonoids, steroids, alkaloids phenols, and thiols.

Quantitative phytochemical analysis
Estimation of Total phenolic content (TPC)
Total phenolic content (TPC) was measured using the 10% Folin-Ciocalteu method described.[12]

Estimation of Total flavonoid content (TFC)
Total flavonoid content (TFC) was determined by using 15% aluminium chloride in the method described.[12]

Estimation of Alkaloids
Alkaloid was estimated quantitatively based on the reaction between alkaloid and bromocresol green (BCG) to form a yellow complex, extractable by chloroform at pH 4.7 according to previous reports.[4,13,14]

In-Vitro Antioxidants Activities evaluation
2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity
A concentration of 0.03 mM 2,2-Diphenyl-1-picrylhydrazyl (DPPH) was used to determine the radical scavenging activity of the leaves extract following the previous investigations of [14] adopted by [4] with slight modification.

Ferric reducing antioxidant power (FRAP)
The ferric-reducing power was measured by direct electron donation in the reduction of $Fe^{3+}(CN)_6$ to $Fe^{2+}(CN^-)_6$, using 1% $Fe^{3+}(CN)_6$ according to the reports of[2,12,13,14] with little modification.
Nitric oxide (NO) scavenging activity
Nitric oxide (NO) scavenging activity of the extracts was determined as described.[15]

Total antioxidant capacity (TOAC)
The assay is based on the reduction of Mo(VI)-Mo(V) in the extract and the subsequent formation of a green phosphate/Mo(V) complex at acidic pH as reported.[4,16]

In-vitro anti-inflammatory activities evaluation
In-vitro anti-inflammatory activity of ethanol extracts of *Uveria chamae* was evaluated by the assessment of inhibition of albumin denaturation, membrane stabilization, and anti-proteinase activity as contained in earlier reports.[17,18]

Gas chromatography-mass spectrometry (GC–MS) analysis
Analysis to identify bioactive compounds in the ethanol leaf extract of *U. chamae* was carried out using GC-MS by operating MSD in Scan mode to ensure all levels of discovery of the board constituents. Agilent 7820A gas chromatograph coupled to 5975C inert mass spectrometer (with triple axis detector) with electron-impact source was used. The stationary phase of separation of the compounds was an HP-5 capillary column coated with 5% Phenyl Methyl Siloxane (30 m length x 0.32 mm diameter x 0.25 µm film thickness) (Agilent Technologies). Helium, the carrier gas was kept at a constant flow of 1.4871 mL/min with an initial nominal pressure of 1.4902 psi and an average velocity of 44.22 cm/sec. 1 µL of ethanol leaf extract of *U. chamae* was injected in splitless mode at an injection temperature of 300 °C. Purge flow to spilt vent was 15 mL/min at 0.75 min with a total flow of 16.654 mL/min; gas saver mode was switched off. The oven was initially programmed at 40 °C for (1 min) and then ramped at 12 °C/min to 300 °C (10 min). Run time was 32.667 min with a 5 min solvent delay. The mass spectrometer was operated in electron-impact ionization mode at 70eV with an ion source temperature of 230 °C, quadrupole temperature of 150 °C, and transfer line temperature of 280 °C. Acquisition of ion was via Scan mode (scanning from *m/z* 45 to 550 amu at 2.0s/scan rate). The bioactive compounds in the plant extracts were identified based on retention time (min), peak area, peak height, and mass spectral patterns comparisons with data on compounds in the database of the National Institute of Standards and Technology (NIST).

Statistical analysis
Data were subjected to statistical analysis using SPSS version 16. Values were presented as Mean ± SD while one-way ANOVA was used to test for differences between treatment groups. The results were considered significant at p-values of less than 0.05, that is, at a 95% confidence level ($p<0.05$)

Results and discussion

In this study, bioactive compounds saponins, terpenes, alkaloids, flavonoids, and phenol were confirmed present from the result of the qualitative phytochemistry of ethanol extract of *Uvaria chamae* leaves (Table 1). These tenders are in agreement with earlier investigations[43] but at variance with the reports of [44,45] that documented the presence of phlobatanin and thiols in qualitative studies of *Uveria Chamae* extracts. These Variations in reports may be traced to environmental factors, geographical locations, extracting solvent choice, and season of collection as well as handling activities.[12]
Alkaloids, phenols, flavonoids, and tannins are crucial indicators used to evaluate the phytochemicals and the antioxidant attributes of medical plants. In with this, Table 2 show the quantitative values of tannins, phenols, flavonoids and Alkaloids obtained from *Uveria Chamae* ethanol extracts with Flavonoids possesses the highest value of 1.28±0.00 mg/g CAE. This suggest further evidences in the support of recent scientific findings on the importance of human intake of phytochemicals such as carotenoids, polyphenols, isoprenoids,

ISSN 2955-1226 (Print)
ISSN 2955-123(Electronic)

phytosterols, saponins, dietary fibres, and polysaccharides from stem and root extracts of *U. chamae* plant to prevent free radicals-induced diseases.[31] This rising interest has led to the promotion and appreciation of phytochemicals (tannins, phenols, flavonoids and alkaloids) to the populace of striving nations as food ingredients and a preventive measure for many diseases.[46] The health benefits of plant extracts phytochemicals depends primarily on antioxidant properties attributed gear from the rich content of phenolic compounds, flavonoids, and other bioactive constituents. These compounds possess the ability to scavenge free radicals and inhibit lipid peroxidation, thereby protecting cellular integrity from oxidative damage[30] In furtherance, these results correlates the previous investigations of *Uvaria chamae* demonstration of significant antioxidant activity in both its root and seed extracts, suggesting that this plant may serve as a valuable source of natural antioxidants.

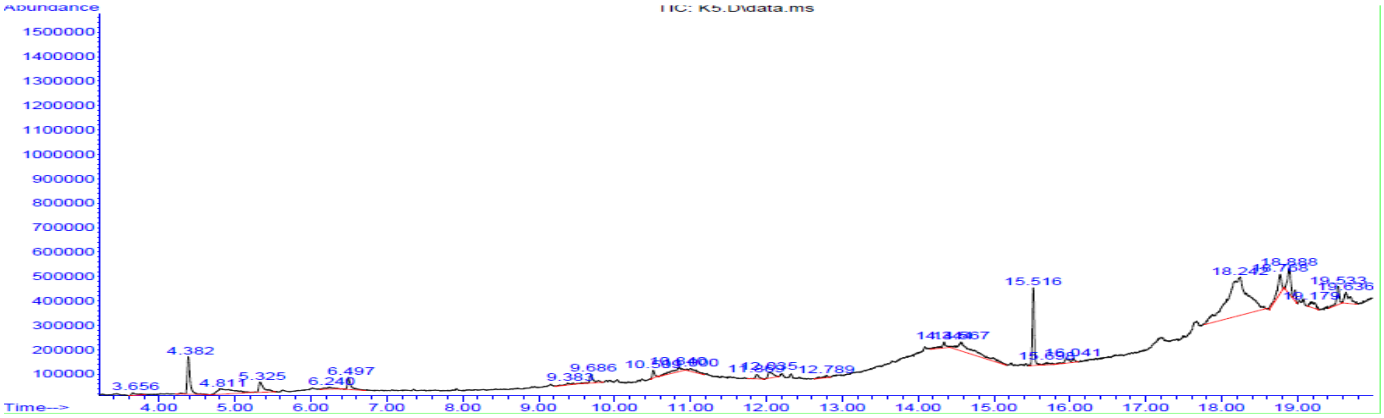

Figure 1: Gas chromatography-mass spectroscopy (GC-MS) Chromatogram of *U. chamae* ethanol leaves extracts.

Table 1: Qualitative phytochemistry of ethanol extract of *U. chamae* leaf

Serial Number	Phytochemical	Ethanol Extract
1	Saponins	+
2	Phlobatanin	-
3	Cardiac glycoside	+
4	Flavonoids	+
5	Tannins	+
6	Phenol	+
7	Terpenes	+
8	Steroids	+
9	Alkaloids	+

Key: + =Present; - = Absent

Table 2: Quantitative phytochemistry result of ethanol extract of *U. chamae* leaf

Phytochemical	Ethanol Extract
Phenol (mg/g GAE)	0.78±0.01
Flavonoid (mg/g CAE)	1.28±0.00
Tannin (mg/g TAE)	0.62±0.02
Alkaloid (mg/g ATE)	0.81±0.00

Values are mean ± Standard deviation of triplicate determinations. GAE = Gallic acid equivalent, CAE =Catechin equivalent, TAE = Tannic acid equivalent, ATE =Atropin equivalent.

The ethanol extract of *U. chamae* leaves was observed and depict a concentration-dependent activity in the scavenging of reactive species and inhibition potency of *U.chamae* ethanol extracts as shown in table 3a and 3b. These actions are connoted by the reduction of colour intensity of the reaction in this assay and suggest the possible interactions of bioactive compounds of the extract causing protonation of hydrogen ion, stabilizing electron, inhibiting and chelating properties in the microenvironment of reactive species. Superoxide anion radical, hydrogen peroxide, and hydroxyl radical are reactive oxygen species (ROS) generated in all cells due to either endogenous metabolic processes or exogenous stimuli. However, cells in demand to maintain metabolic balance, initiate cellular mechanisms to reduce the oxidative potential of ROS by activating several antioxidant systems. Secondary metabolites such as Phenols, flavonoids, and alkaloid compounds are known to be powerful antioxidants based on their ability to reduce proton donation, oxygen radicals, and chelated metal scavenging potential[48] are crucial determinants of the free radical scavenging activity of plants.[47] The potentials of *Uveria chamae* extracts to scavenged the DPPH radical, ferric reducing antioxidant power (FRAP), nitric oxide (NO), and total antioxidant capacity (TOAC) was seen obviously as ethanol leaf extract of *U. chamae* observed significant increased antioxidant activity in a dose-dependent manner against DPPH, FRAC, NO, and TAOC this again buttressed the antioxidant activity viability of *Uveria chamae* extracts evaluated in these study. In plants, one of these defense systems is polyphenols, making this family of compounds a recent focus for inclusions in food and pharmaceutical products. The current findings on the antioxidant qualities of medicinal plants are in consistent with previous research on this subject.[49,50]

Table 3a: *In-vitro* antioxidant result of *U. chamae* Ethanol leaf extract

Conc.	% Inhibition		700nm	695nm
(mg/ml)	DPPH	NO	FRAP	TOAC
0.20	36.9±1.37^{a}	5.51±0.20^{a}	0.21±0.00^{a}	0.44±0.01^{a}
0.40	52.4±1.08^{b}	26.9±0.77^{b}	0.24±0.00^{b}	0.63±0.03^{b}
0.60	63.5±0.78^{c}	35.7±1.45^{c}	0.43±0.01^{c}	0.82±0.02^{c}
0.80	81.1±0.79^{d}	47.4±1.82^{d}	0.63±0.01^{d}	1.25±0.02^{d}
1.00	84.4±0.90^{e}	60.4±0.17^{c}	0.84±0.01^{e}	1.52±0.02^{e}

Values are means ± standard deviations of quadruple determinations. Values with different superscripts on the same column differ significantly (p<0.05).

ISSN 2955-1226 (Print)
ISSN 2955-123(Electronic)

Table 3b: IC_{50} values of the *in-vitro* free radical scavenging activities of Ethanol extract of *U. chamae* leaves.

Parameters	Ethanol extract (mg/mL)	Standard (mg/mL)
TOAC	0.29±0.01[a]	0.06±0.00[b]
FRAP	0.59±0.04[a]	0.05 ±0.00[b]
NO	0.71±0.02[a]	0.08±0.00[b]
DPPH	0.38±0.02[a]	0.08±0.00[b]

Values are presented as means ± standard deviations of triplicate determinations. Values with different superscripts on the same row differ significantly (p<0.05).

Nitric oxide is a molecule that is produced by neurons, macrophages, and endothelial cells. It is involved in the control of several physiological processes, including inflammation. However, several disorders have been linked to increased NO production.[51] Cell damage during inflammation makes the cell prone to added damage by free radical-induced lipid peroxidation.[52] One major biomolecule affected during inflammatory response is proteins. Proteins play a crucial function in the biochemical and physiological processes in the body, albumin is one major protein in the body responsible for the transport of other essential biomolecules and also an indicator of the health status of an individual. Transport in cells is a pivotal need in the quest for cellular survival and existence. Thus, protecting the integrity of albumin is important and serves as a target in addressing inflammatory disease. Membrane stabilization is another indicator inflammatory that can be achieved by inhibiting hypotonicity-induced lysis of the membranes of the lysosomal vesicles that release their component enzymes to induce the inflammatory response. Thus, a stabilized membrane prevents the release of its contents as well as the progression of inflammation. The erythrocyte membrane is similar to the lysosomal membrane .[53] The stabilization indices presented in tables 4a and 4b suggest the stabilising potentials of *U. chamae* ethanol leaf extract on lysosomal membrane proteins that further validates previous records of plant extracts to stabilise membranes, albeit the precise mechanism of this activity is yet unknown, but a possible reason for this activity might be a rise in concentration variables, such as the cell's area/volume ratio.[55]. The stabilization of lysosomal membranes is crucial for limiting the inflammatory response because it stops the release of lysosomal components of activated neutrophils, such as proteases and bactericidal enzymes, which, when released extracellularly, can caused additional tissue damage and inflammation.[54] Stabilization of the cell membrane is decreased lipid peroxidation hence minimizing cell damage and inflammation, therefore ethanolic extracts of *Uvaria chamae* leaves rich with high content of flavonoids(table 2) can protect cell membrane integrity against inflammation and related deseases.[56] Another possible target in addressing cellular crisis resulting from inflammation is the inhibition of the activities of proteinase enzymes. Table 4 show the antiproteinase increased significantly across concentration of U.chamae ethanolic extracts. This results suggested the annealing power of the U.chamae leave extracts to deleterious activities of proteinase and gives the cell an alternative measure for maintaining the equilibrium stability of the cell components. The findings is also in accordance with a previous study.[17] The possible anti-inflammatory properties of the examined leaf extracts may stem from the capacity to suppress antiprotease activity with wealth properties of flavonoids(table 2) to lipid peroxidization in tissues. Polyphenols are multi-structural secondary metabolites derived from phenolic acids, condensed tannins, and highly polymerized substances, among other components. The observation of phenols in the ethanol leaves extracts of *U.chamae* again suggest the health benefits and viability extract often ascribed to their potential ability to act as antioxidants, antifungal, anti-glycemia, anti-inflammatory, and anti-tumour.[57] Plants are effective in modifying mood by the effect on the monoamine neurotransmission, similar to Hypericum perforatum, as well as have an impact on GABA, opioid, and cannabinoid systems.[60 59] The bioactive compounds and their derivatives identified in the present study of *U chamae* leaf extract has notable biological functions such as antimicrobial, antioxidant antitumour, and antiglycaemic preseted in Table 5. As a phyto component of this plant reserved unique compounds with biological activities of sourced by humans for centuries in folk medicinal usage to protect against microbial infections, ageing, and industrial environmental health effects. However, results of twenty-seven vital compounds identified from ethanol extracts of *U. chamae* as showed in table 5 suggested further the implication of the plant extracts in neurological function associated with the binding of Adenosine receptor (A2A type), psychotropic to affect the cardiovascular system, immune response, Group I mGluR (metabotropic glutamate receptors) receptors modulator and neuroprotection in acute and chronic pathological conditions.[58,59,61]

Table 4a: *In-vitro* anti-inflammatory activity of *U. chamae* ethanol leaf extract

Conc. (mg/ml)	% Inhibition		
	Albumin denaturation	Antiproteinase	Membrane stabilization
0.02	36.3± 0.38[a]	6.23± 1.04[a]	17.5±0.93[a]
0.04	37.9±0.30[b]	15.9± 0.68[b]	23.7±1.86[b]
0.06	39.4±0.23[c]	30.3± 1.02[c]	33.6±0.47[c]
0.08	40.9±0.23[d]	33.4± 0.86[d]	39.8±0.93[d]
0.10	43.7±0.53[e]	37.8±1.02[e]	48.1±2.34[e]

Values are presented as means ± standard deviations of triplicate determinations. Values with different superscripts on the same row differ significantly (p<0.05).

Table 4b: IC_{50} values of *in-vitro* anti-inflammatory activities of *U. chamae*

Parameters	Ethanol extract (mg/mL)	Aspirin (mg/mL)
Antiproteinase	0.10±0.01[a]	1.30±0.02[b]
Membrane Stabilization	0.07±0.01[a]	1.03±0.02[b]
Albumin denaturation	0.27±0.01[a]	0.63±0.02[b]

Values are means ± standard deviations of triplicate determinations. Values are presented as means ± standard deviations of triplicate determinations. Values with different superscripts on the same row differ significantly (p<0.05).

ISSN 2955-1226 (Print)
ISSN 2955-123(Electronic)

Table 5: Bioactive Compounds detected from Gas Chromatography-Mass Spectroscopy of Ethanol leaf extract of *U. Chamae*

Compound	RT (min)	Area (%)	PubChem I.D.	Name	Molecular weight (g/mol)	Molecular formula	Biological activities
1	3.656	0.67	53396325	Pent-1-en-3-one, 1-diethylamino-4, 4-dimethyl-	155.24	$C_9H_{17}NO$	Group I mGluR (metabotropic glutamate receptors) receptors modulator and neuroprotection in acute and chronic pathological conditions[19]
2	4.382	5.41	119838	4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl-	144.12	$C_6H_8O_4$	Flavonoid compound with antimicrobial, anti-inflammatory, and antioxidant capacity [20]
3	4.811	4.47	243	Benzoic acid	122.12	$C_7H_6O_2$	Antibacterial, antifungal, anti-inflammatory and antilipidemic[21]
4	5.325	2.62	10329	Benzofuran, 2,3-dihydro-	120.15	C_8H_8O	anti-inflammatory, antimicrobial, antifungal, antihyperglycemic, analgesic, antiparasitic, and antitumor [22]
5	9.686	1.65	602019	4-Methyl-2,5-dimethoxybenzaldehyde	180.20	$C_{10}H_{12}O_3$	Anticancer, anti-inflammatory and antioxidant.[59]
6	6.497	2.05	332	2-Methoxy-4-vinyl phenol	150.17	$C_9H_{10}O_2$	Anticancer, anti-inflammatory, antiaging, and antioxidant activity[23]
7	9.686	1.65	15604	9H-Fluorene, 1-methyl-	180.24	$C_{14}H_{12}$	antimicrobial and anticancer agents.[23]
8			582351	Benzeneacetic acid, α-cyano-, ethyl ester	228.25	$C_{13}H_{12}N_2O_2$	Antifungal activities[24]
9	19.636	2.92	35725	1H-Indole-2-carboxylic acid, 6-(4-ethoxy phenyl)-3-methyl-4-oxo-4,5,7-tetrahydro-, isopropyl ester	562.129	$C_{27}H_{36}ClN_5O_4S$	Antioxidant and antiglycemic[25]
10	19.636	2.92	10471670	3-Benzoyl-4-(4-aminophenyl)-1,2-dihydrobenzo[d]azepine	327.43	$C_{23}H_{21}NO$	Analgesic antitumor antimicrobial, antiviral, analgesic, and anti-inflammatory [26]
11	19.533	2.60	91703591	2-(Trimethylsilyl)oxy benzylidene acetophenone	296.4	$C_{18}H_{20}O_2SI$	Antitumor and antioxidant[27]
12	11.869	0.74	91753526	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	180.20	$C_{10}H_{12}O_3$	Anticancer, antioxidant and anti-inflammatory[27]
13	12.035	1.55	642630	Quinoline,decahedron-1-methyl-cis-	153.26	$C_{10}H_{19}N$	Antiplasmodial and Antitrypanosomal [28]
14	12.035	1.55	573583	1-Azaspiro[5,5]undecane	153.26	$C_{10}H_{19}N$	Neuropathic analgesic [29]
15	12.789	0.62	138905	1-Chloro-2,4-dimethoxybenzene	172,61	$C_8H_9ClO_2$	Antibacterial and Antifungal [25]
16	12.789	0.62	27372	N-Acetyl-dl-penicillamine	191.25	$C_7H_{13}NO_3S$	Treatment 7f Wilson disease, rheumatoid arthritis, and cystinuria. Antimicrobial, antithrombotic, and antidote to metal poisoning [30]
17	12.789	0.62	445580	Doconexent (Docosahexaenoic)	328.5	$C_{22}H_{32}O_2$	Central nervous system and cardiovascular health enhancer [31]

18	14.344	1.37	599078	1,8-Naphthyridine, 2,4,7-trimethyl	172.23	$C_{11}H_{12}N_2$	Ant infectious, Anticancer, Neurological in the binding of Adenosine receptor (A2A type), psychotropic, affecting the cardiovascular system, and immune response [32]
19	14.344	1.37	599057	1-Naphthol, 6,7-dimethyl-	172.22	$C_{12}H_{12}O$	antioxidant, antimicrobial antifungal, and antitumor [33, 61]
20	14.344	1.37	132548355	2-(Quinolin-8-ylmethylamino benzaldehyde	262.30	$C_{17}H_{14}N_2O$	Cardiovascular diseases, anti-inflammatory suppressant, antiviral and antimicrobial [34]
21	14.567	7.38	599023	2-Cyclopenten-1-one, 3-methyl-2-phenyl-	172.22	$C_{12}H_{12}O$	Antioxidant and antimicrobial [35]
22	14.567	7.38	599008	Butyric acid, 3-(dimethylamino)-4-phenyl-, butyl ester	263.37	$C_{16}H_{25}NO_2$	Treatment in relative drug-naïve to *schizophrenia*. [36; 60]
23	15.516	7.40	5280435	Phytol	296.5	$C_{20}H_{40}O$	Antinociceptive, anti-inflammatory antidiabetic and antioxidant [37]
24	15.698	0.62	19576	2-Ethylcyclohexanol, TMS derivative	128.21	$C_8H_{16}O$	Antimicrobial and antioxidant [38]
25	16.041	1.70	253661366	Trans-4-(4'-N-Butylcyclohexyl)-Benzonitrile	241.37	$C_{17}H_{12}N$	Inhibition of lysine-specific demethylase 1, antiviral and antihypertensive [39]
26	3.656	0.67	143568	4H-1,2,4-Triazol-3-amine, 4-propyl	126.16	$C_5H_{10}N_5$	antifungal, antibacterial, anticancer, anticonvulsant, antituberculosis, antiviral, antiparasitic, analgesic and anti-inflammatory agents [40]
27	10.509	0.89	7568320	Goitrin	129.18	C_5H_7NOS	Prevent tyrosine iodination and inhibit T4 formation [41,42]

Conclusion

Our study revealed the composite compounds of *U. chamae* which are known to possess cellular protecting activities acquired the rich pytocontent of phenols, alkanoids, tannins and high concetration of flavonoids including pharmacological activities neuroprotection and immunomodulation attributed to presence of Pent-1-en-3-one, 1-diethylamino-4, 4-dimethyl, Butyric acid, 3 (dimethylamino)-4-phenyl butyl ester, and 1,8-Naphthyridine, 2,4,7-trimethyl our findings suggest the neuroactivities of U.chamae extracts as potential agents to combat neuro-oxidative conditions associated with neuropsychiatric functions especially those related to dopaminergic and glutamatergic neurotransmitter, a new wave in medicinal applications of the leaves of *Uvaria chamae*.

Conflict of Interest

The authors declare no conflict of interest.

Author's Declaration

The authors hereby declare that the work presented in this article is original. Any liability for claims relating to this article will be borne by us.

Acknowledgement

The authors acknowledge the professional role and support of Professor H. A. Akinnibosun and Professor J.C. Mordi from the University of Benin, Benin City, and Delta State University, Abraka respectively. We appreciate A. O. Ohwokevwo for his Laboratory support and technical provisions during crucial moments of this research.

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