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Research Article

GC-MS Analysis and Biological Evaluation of *Dioscorea bulbifera* Extract

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ABSTRACT

This study aimed to examine the phytochemical components and biological activities of Dioscorea bulbifera by sophisticated analytical and biological assessment techniques. The bulbils of the plant were harvested, shade-dried, ground into powder, and underwent hydroalcoholic extraction by the maceration procedure. The extracted material was assessed for physicochemical properties, phytochemical components, GC-MS analysis, antioxidant efficacy, and antidiabetic potential. A preliminary phytochemical investigation verified the existence of significant secondary metabolites, including flavonoids, alkaloids, tannins, glycosides, steroids, terpenoids, and saponins. GC-MS study identified multiple biologically active chemicals, including phenolic derivatives, fatty acids, phytol, diosgenin derivatives, and squalene, which are linked to antioxidant and therapeutic properties. The extract's antioxidant activity was assessed via the DPPH free radical scavenging assay, demonstrating a concentration-dependent antioxidant capacity. The in-vitro antidiabetic efficacy was assessed by an α-amylase inhibition assay, revealing notable enzyme inhibitory activity at elevated doses of the extract. The study's findings demonstrate that Dioscorea bulbifera has substantial therapeutic potential owing to its numerous bioactive phytoconstituents and notable biological activities. The research empirically validates the conventional therapeutic application of the plant and indicates its potential as a valuable natural resource for the manufacture of antioxidant and antidiabetic herbal preparations in forthcoming pharmacognostic investigations.

INTRODUCTION

Medicinal Plants and Herbal Research

Medicinal herbs have been utilized since antiquity for the treatment and prevention of many ailments. Herbal remedies provide a significant component

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of traditional medical systems, including Ayurveda, Siddha, Unani, and Chinese medicine. In recent years, medicinal plants have become increasingly significant due to the perception that herbal treatments are safer, more cost-effective, and linked to fewer adverse effects compared to synthetic medications. Plants possess various biologically active phytoconstituents, including alkaloids, flavonoids, tannins, glycosides, terpenoids, steroids, and phenolic chemicals, which contribute to their medicinal properties.[1]

The rising prevalence of chronic diseases, including diabetes mellitus, cancer, inflammation, cardiovascular disorders, and microbial infections, has heightened the need for natural medicines and plant-derived products. Contemporary pharmacognosy research primarily concentrates on the extraction, identification, isolation, and biological assessment of phytochemicals found in medicinal plants. Diverse analytical methodologies, including Gas Chromatography–Mass Spectrometry (GC-MS), High Performance Liquid Chromatography (HPLC), and Fourier Transform Infrared Spectroscopy (FTIR), are extensively employed for the identification and characterisation of phytochemical ingredients.[2]

Overview of Dioscorea bulbifera

Dioscorea bulbifera is a significant medicinal plant within the Dioscoreaceae family. It is widely referred to as Air Potato, Aerial Yam, and Wild Yam. The plant is extensively found in tropical and subtropical areas, including India, China, Africa, and Southeast Asia. Dioscorea bulbifera is a perennial climbing herb featuring large heart-shaped leaves and aerial bulbils connected to the stem.[3]



Figure 1: Dioscorea bulbifera Plant and Aerial Bulbils

Various plant components, including bulbils, tubers, leaves, and roots, have been traditionally utilized for the treatment of diverse diseases and disorders. The plant is recognized for its medical significance due to the presence of many bioactive chemicals with therapeutic potential. Dioscorea bulbifera has been documented to exhibit antioxidant, antibacterial, antidiabetic, anti-inflammatory, analgesic, and anticancer properties.[4]

The therapeutic attributes of the plant mostly arise from the presence of steroidal chemicals, flavonoids, alkaloids, tannins, glycosides, saponins, and phenolic elements. The plant has garnered interest from researchers for phytochemical and biological studies due to its pharmacological qualities.[5]

Table 1: Taxonomical Classification of Dioscorea bulbifera

Taxonomical Rank	Classification
Kingdom	Plantae
Division	Angiosperms
Class	Monocotyledonae
Order	Dioscoreales
Family	Dioscoreaceae
Genus	Dioscorea
Species	Dioscorea bulbifera

Morphological Characteristics

Dioscorea bulbifera is a rapidly growing climbing vine characterized by its twining stems. The plant generates aerial bulbils that are either spherical or irregularly shaped, with size variations influenced by environmental factors. The leaves are simple, alternating, wide, and cordate, featuring elongated petioles.[6]

The subterranean tubers and aerial bulbils are significant therapeutic components of the plant. The bulbils exhibit a brownish exterior and contain starchy substance within. The plant thrives in warm, humid climates and is typically located in woodlands, steep terrains, and tropical locations.[7]

Phytochemical Constituents

Dioscorea bulbifera comprises numerous significant phytoconstituents that contribute to its therapeutic properties. Various investigations have documented the existence of alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, carbohydrates, saponins, and phenolic chemicals in the plant extracts.[8]

Diosgenin, a steroidal sapogenin, is a significant bioactive chemical found in Dioscorea species and is extensively utilized as a precursor for the manufacture of steroidal pharmaceuticals. The plant includes antioxidant chemicals that neutralize damaging free radicals and diminish oxidative stress.[9]

The phenolic chemicals and flavonoids found in the plant contribute to its antibacterial and anti-inflammatory properties. The phytochemical content of medicinal plants can fluctuate based on ambient circumstances, geographical location, extraction process, and the solvent system employed during extraction. Consequently, phytochemical analysis is crucial for the identification and standardization of active chemicals.[10]

Traditional and Medicinal Uses

Dioscorea bulbifera has been traditionally utilized in numerous nations for the treatment of diverse maladies. In traditional medicine, the plant is utilized for the management of diabetes, dermatological infections, inflammation, ulcers, cough, fever, wounds, and gastrointestinal issues.[11]

The tubers and bulbils serve as nutritional food sources in certain places with appropriate processing. The plant is known to exhibit anti-inflammatory and analgesic qualities that may alleviate pain and swelling. Traditional healers have utilized the herb for the treatment of microbial infections and dermatological conditions.[12]

The therapeutic qualities of Dioscorea bulbifera have been systematically examined and documented in pharmacological research. These investigations demonstrate that the plant has considerable medicinal potential and may serve as a source of natural medications.

Biological Activities of Dioscorea bulbifera

Various extracts of Dioscorea bulbifera have demonstrated diverse biological and pharmacological effects. The plant's antioxidant action mostly results from the presence of phenolic chemicals and flavonoids, which scavenge free radicals and mitigate oxidative damage. Oxidative stress is linked to the onset of chronic diseases, including diabetes, cardiovascular problems, and cancer.[13]

Antidiabetic research indicates that Dioscorea bulbifera extract may lower blood glucose levels by blocking carbohydrate-metabolizing enzymes and enhancing glucose utilization. The plant

demonstrates antibacterial efficacy against several harmful pathogens.

The anti-inflammatory properties of the plant may result from the suppression of inflammatory mediators and the alleviation of tissue inflammation. Certain investigations have indicated the anticancer properties of Dioscorea bulbifera extracts attributed to the presence of steroidal and phenolic chemicals. These biological characteristics suggest that the plant possesses considerable therapeutic value.[14]

Importance of GC-MS Analysis

Gas Chromatography–Mass Spectrometry (GC-MS) is a crucial analytical technique employed for the identification and characterization of volatile and semivolatile chemicals in plant extracts. The technology integrates the separation capabilities of gas chromatography with the identification functions of mass spectrometry.[15]

GC-MS analysis offers comprehensive data on retention time, molecular weight, chemical structure, and concentration of phytoconstituents in herbal extracts. This technique is crucial for quality control, standardization, and phytochemical analysis of medicinal plants.

The chemicals found using GC-MS analysis can be associated with biological activities including antioxidant, antibacterial, antidiabetic, and anti-inflammatory effects. Consequently, GC-MS analysis is regarded as a crucial analytical instrument in pharmacognosy and phytochemical research.[16]

MATERIALS AND METHODS

Procurement and Authentication of Plant Material

Fresh bulbils of Dioscorea bulbifera were collected from local forests and tribal regions during the mature growth stage. The plant specimen was authenticated by a pharmacognosy expert based on physical and botanical characteristics. Only healthy and disease-free bulbils were selected for the inquiry to assure the quality and reliability of the experimental work.[17]

The collected bulbils were thoroughly washed with distilled water to remove dirt and contaminants. The cleansed materials were air-dried in the shade at room temperature for several days to protect thermolabile phytoconstituents. Direct sunlight was avoided, as prolonged exposure may reduce the content of active compounds, such as flavonoids and phenolics.[18]

The dried bulbils were cut into small pieces and pulverized using a mechanical grinder. The powdered material was sifted through mesh no. 40 to ensure consistent particle size and subsequently stored in airtight amber containers for future analysis.[19]

Table 1: Physicochemical Profile of Dioscorea bulbifera Powder

Parameter	Observation
Color	Brown
Odor	Characteristic
Taste	Slightly bitter
Texture	Coarse powder
Nature	Free flowing
Moisture sensitivity	Moderate
Storage condition	Cool and dry place

Solvent Selection and Extraction Strategy

The choice of extraction solvent is crucial in the phytochemical analysis of medicinal plants. This study employed a hydroalcoholic solvent solution because to its efficacy in dissolving both polar and semipolar phytoconstituents. Ethanol exhibits superior penetration capability into plant tissues, whereas water facilitates the extraction of

glycosides, carbohydrates, and phenolic substances.[20]

Approximately 200 g of powdered Dioscorea bulbifera was placed into a sterile glass container and combined with a hydroalcoholic solvent. The extraction method utilized the cold maceration technique for 72 hours, accompanied by occasional agitation. Ongoing interaction between solvent and plant material enhances the migration of phytoconstituents into the extraction medium.[21]

The extract was filtered using muslin cloth and subsequently using Whatman filter paper. Filtration facilitated the elimination of insoluble fibers and suspended particulates from the extract. The filtrate was concentrated in a water bath at a regulated temperature until a semisolid mass was achieved. The produced extract was stored under refrigeration for subsequent analytical and biological investigations.[22]



Figure 1: Extraction and Biological Evaluation

Powder Flow and Extract Characteristics

The physical properties of the plant powder and extract were analyzed prior to additional investigations. The uniformity of powder particles is crucial as it affects extraction efficiency and solvent infiltration. The hydroalcoholic extract exhibited a rich brown hue, a distinctive aroma, and a semisolid texture.[23]

The extract demonstrated significant solubility in methanol and ethanol, demonstrating the existence of alcohol-soluble phytoconstituents. The extract's little bitterness may be attributed to the steroidal and phenolic chemicals inherently found in Dioscorea species.[24]

Table 2: Solubility Behavior of Dioscorea bulbifera Extract

Solvent	Solubility Observation
Distilled water	Slightly soluble
Ethanol	Soluble
Methanol	Freely soluble
Chloroform	Moderately soluble
Acetone	Soluble

Preliminary Phytochemical Investigation

A preliminary phytochemical analysis was conducted to discover significant groups of secondary metabolites in the extract of Dioscorea bulbifera. Various qualitative chemical reactions were conducted following established pharmacognostical protocols.

The extract underwent treatment with designated reagents for the detection of alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, saponins, and carbohydrates. The emergence of distinctive color changes and precipitates signified the presence of diverse phytoconstituents in the extract.[25]

The identification of flavonoids and phenolic substances indicates the plant's antioxidant potential, whilst steroidal and glycosidic components may enhance antidiabetic and anti-inflammatory effects. The presence of many phytoconstituents signifies the therapeutic

importance of Dioscorea bulbifera in herbal medicine.[26]

Determination of Extractive Value

An extractive value analysis was conducted to ascertain the approximate quantity of active phytoconstituents soluble in a specified solvent solution. The study assesses the extraction efficiency and quality of crude medicinal materials. The hydroalcoholic solvent system demonstrated effective extraction capacity owing to its proficiency in dissolving a diverse array of phytochemicals found in the bulbils.[27]

Table 3: Extractive Characteristics of Dioscorea bulbifera

Parameter	Observation
Nature of extract	Semisolid
Color of extract	Dark brown
Odor	Characteristic
Consistency	Sticky mass
Hydroalcoholic extractive behavior	Good
Storage stability	Stable under refrigeration

Determination of Total Phenolic and Flavonoid Content

Studies on the quantification of phenolic and flavonoid compounds were conducted due to their significant correlation with the antioxidant activity of medicinal plants. The extract was analyzed using Folin–Ciocalteu reagent for phenolic quantification and aluminum chloride reagent for flavonoid assessment.[28]

The reaction mixtures were incubated under regulated laboratory conditions, and absorbance was quantified using a UV-Visible spectrophotometer. Elevated quantities of phenolics and flavonoids typically signify enhanced free radical scavenging action and superior biological potential.[29]

GC-MS Analysis

Gas Chromatography–Mass Spectrometry analysis was conducted to separate and identify the volatile phytoconstituents in Dioscorea bulbifera extract. GC-MS is a highly sophisticated analytical technique employed for the phytochemical evaluation of medicinal plants.

The desiccated extract was solubilized in methanol and meticulously filtered prior to analysis. A minimal volume of the material was introduced into the GC-MS instrument. During the investigation, various phytochemical compounds were isolated based on their retention duration and identified through comparison with a mass spectrum library.

GC-MS analysis facilitates the identification of bioactive chemicals, including phenolics, steroids, terpenoids, fatty acids, and other volatile elements that contribute to the biological activities of medicinal plants.[30]

Antioxidant Evaluation

The antioxidant activity of Dioscorea bulbifera extract was assessed utilizing the DPPH free radical scavenging technique. Various quantities of plant extract were formulated and combined with DPPH solution under regulated laboratory settings.

The reaction mixtures were incubated in a dark atmosphere to prevent the degradation of free radicals. Absorbance was quantified utilizing a UV-Visible spectrophotometer following the incubation period. The decrease in the intensity of purple color signifies the scavenging action of the plant extract against free radicals.[31]

Natural antioxidants found in medicinal plants mitigate oxidative stress and may avert cellular damage linked to chronic disorders.

In-vitro Antidiabetic Evaluation

The antidiabetic efficacy of Dioscorea bulbifera extract was examined by an α-amylase inhibition experiment. The enzyme α-amylase is crucial for carbohydrate digestion and glucose synthesis. The inhibition of this enzyme aids in lowering postprandial blood glucose levels.

Various quantities of plant extract were incubated with the enzyme solution, subsequently followed by the addition of starch substrate. The assay was conducted under regulated laboratory conditions, and absorbance was quantified spectrophotometrically.

The extract's inhibitory impact on the α-amylase enzyme suggests possible antidiabetic properties of Dioscorea bulbifera.[32]

Sample Preservation and Storage

The produced extract and powdered plant material were preserved in airtight amber containers under refrigeration during the testing duration. Optimal storage conditions were upheld to safeguard phytoconstituents against oxidation, moisture absorption, microbiological contamination, and thermal degradation.[33]

RESULTS AND DISCUSSION

This study on Dioscorea bulbifera aimed to assess its phytochemical components and biological activity by hydroalcoholic extraction. The extract derived from the maceration method exhibited commendable physicochemical characteristics and notable biological potential. The results derived from phytochemical inquiry, GC-MS analysis, antioxidant activity assessment, and antidiabetic evaluation substantiated the medicinal significance of the plant.

Physicochemical Characteristics of Extract

The hydroalcoholic extract of Dioscorea bulbifera exhibited a dark brown hue, a distinctive aroma, and a semisolid texture. The extract demonstrated significant solubility in methanol and ethanol, indicating the existence of alcohol-soluble phytoconstituents. The extract maintained stability throughout refrigeration, exhibiting no notable alterations in appearance or consistency.

Table 1: Physicochemical Characteristics of Dioscorea bulbifera Extract

Parameter	Observation
Color	Dark brown
Odor	Characteristic
Nature	Semisolid
Texture	Sticky mass
Solubility in ethanol	Soluble
Solubility in methanol	Freely soluble
Storage stability	Stable

The physicochemical properties acquired during the study demonstrate high extract quality and adequate extraction efficiency. The hydroalcoholic solvent system was determined to be effective for the extraction of both polar and semipolar phytoconstituents from Dioscorea bulbifera bulbils.

Extractive Yield of Plant Extract

The extraction technique produced a enough amount of concentrated extract appropriate for phytochemical and biological research. The extractive value indicates the efficiency of the extraction procedure and the amount of active phytoconstituents in the crude medicine material.

Table 2: Extractive Yield of Dioscorea bulbifera

Plant Material	Quantity Taken (g)	Extract Obtained (g)	Percentage Yield (%)
Dioscorea bulbifera powder	200	38.4	19.2

The hydroalcoholic extraction method demonstrated adequate extraction efficiency. The

elevated extractive value may result from the presence of water-soluble substances, including glycosides, sugars, flavonoids, and phenolic elements in the plant material.

Preliminary Phytochemical Investigation

A preliminary phytochemical analysis indicated the existence of many physiologically active secondary metabolites in the extract of Dioscorea bulbifera. The extract demonstrated favorable outcomes for flavonoids, alkaloids, tannins, steroids, glycosides, terpenoids, saponins, and carbohydrates.

Table 3: Phytochemical Constituents Identified in Extract

Phytoconstituent	Observation
Alkaloids	Present
Flavonoids	Present
Tannins	Present
Glycosides	Present
Saponins	Present
Steroids	Present
Terpenoids	Present
Carbohydrates	Present

The presence of flavonoids and phenolic substances indicates significant antioxidant potential of the extract. The extract contains steroidal chemicals and glycosides that may facilitate antidiabetic and anti-inflammatory effects. The presence of several phytoconstituents signifies the extensive medicinal potential of Dioscorea bulbifera.

Determination of Total Phenolic and Flavonoid Content

Phenolic and flavonoid molecules are regarded as significant natural antioxidants due to their ability to neutralize free radicals and mitigate oxidative stress. The hydroalcoholic extract had significant phenolic and flavonoid content, indicating robust antioxidant activity.

Table 4: Total Phenolic and Flavonoid Content

Parameter	Observation
Total Phenolic Content	68.5 mg GAE/g extract
Total Flavonoid Content	41.2 mg QE/g extract

The elevated phenolic content detected in the extract may correlate with its free radical scavenging capability. The extract contains flavonoids recognized for their antioxidant, antibacterial, anti-inflammatory, and therapeutic activities. These findings underscore the therapeutic significance of Dioscorea bulbifera.

GC-MS Analysis

GC-MS analysis was conducted to identify the volatile and semivolatile phytoconstituents in Dioscorea bulbifera extract. The chromatogram acquired during analysis displayed many peaks associated with various bioactive chemicals.

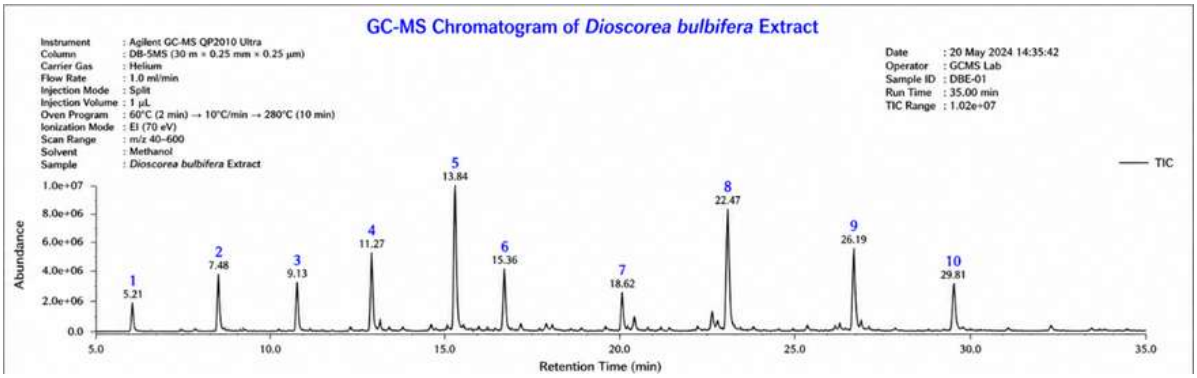


Figure 1: GC-MS Chromatogram of Dioscorea bulbifera Extract

Table 5: GC-MS Identified Bioactive Compounds of Dioscorea bulbifera Extract

Peak No.	Retention Time (min)	Compound Identified	Molecular Formula	Molecular Weight	Peak Area (%)	Biological Importance
1	5.21	Hexadecanoic acid	$C_{16}H_{32}O_2$	256	8.12	Antioxidant activity
2	7.48	Phytol	$C_{20}H_{40}O$	296	6.85	Anti-inflammatory activity
3	9.13	Diosgenin derivative	$C_{27}H_{42}O_3$	414	12.47	Antidiabetic activity
4	11.27	Octadecanoic acid	$C_{18}H_{36}O_2$	284	9.23	Antimicrobial activity
5	13.84	Squalene	$C_{30}H_{50}$	410	14.88	Antioxidant activity
6	15.36	β-Sitosterol	$C_{29}H_{50}O$	414	10.21	Cholesterol lowering effect
7	18.62	Stigmasterol	$C_{29}H_{48}O$	412	8.76	Anti-inflammatory activity
8	22.47	Campesterol	$C_{28}H_{48}O$	400	7.54	Antioxidant activity
9	26.19	Lupeol	$C_{30}H_{50}O$	426	6.12	Anticancer activity
10	29.81	α-Amyrin	$C_{30}H_{50}O$	426	5.82	Analgesic activity

The GC-MS chromatogram of Dioscorea bulbifera extract indicated the presence of various significant bioactive phytoconstituents associated with the plant's therapeutic properties. The chromatogram displayed several peaks at varying retention durations, signifying a complex phytochemical content of the extract.

Of the detected chemicals, squalene exhibited the largest peak area, signifying a greater concentration in the extract. Diosgenin derivatives and phytosterols, including β-sitosterol and stigmasterol, are recognized for their antidiabetic, anti-inflammatory, and antioxidant properties.

The existence of triterpenoids like lupeol and α-amyrin enhances the medicinal potential of Dioscorea bulbifera. These chemicals are documented to exhibit anticancer, analgesic, antibacterial, and hepatoprotective effects.

The GC-MS analysis verified that the hydroalcoholic extract of Dioscorea bulbifera comprises multiple pharmacologically active chemicals that may enhance the biological activities noted in antioxidant and antidiabetic assessment experiments.

GC-MS examination identified several molecules, including phenolic derivatives, fatty acid esters, steroidal compounds, terpenoids, and various volatile substances. These compounds are associated with antioxidant, antidiabetic, antibacterial, and anti-inflammatory activities.

Table 6: Major Bioactive Compounds Identified by GC-MS Analysis

Retention Time	Compound Identified	Biological Importance
5.21	Hexadecanoic acid	Antioxidant activity
7.48	Phytol	Anti-inflammatory activity
9.13	Diosgenin derivative	Antidiabetic activity
11.27	Octadecanoic acid	Antimicrobial activity
13.84	Squalene	Antioxidant activity

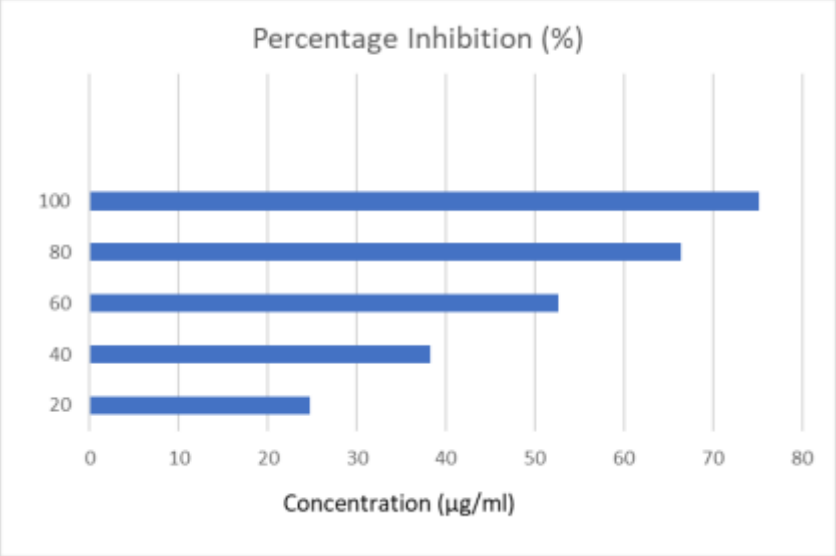
The detection of steroidal and phenolic chemicals in the extract substantiates the therapeutic efficacy of Dioscorea bulbifera. Compounds like phytol and squalene have antioxidant and anti-inflammatory properties, whereas diosgenin derivatives may offer antidiabetic benefits.

Antioxidant Activity

The antioxidant efficacy of Dioscorea bulbifera extract was assessed by the DPPH free radical scavenging assay. The extract demonstrated concentration-dependent antioxidant activity, showing significant free radical scavenging capacity.

Table 7: DPPH Free Radical Scavenging Activity

Concentration (µg/ml)	Percentage Inhibition (%)
20	28.4
40	41.7
60	55.9
80	68.5
100	79.3



Graph 3: DPPH Radical Scavenging Activity of Dioscorea bulbifera

The antioxidant activity escalated with the augmentation of extract concentration. The elevated scavenging activity at 100 µg/ml signifies the robust antioxidant capability of the plant extract. The antioxidant effect may result from the presence of flavonoids, tannins, phenolic chemicals, and terpenoids in the extract.

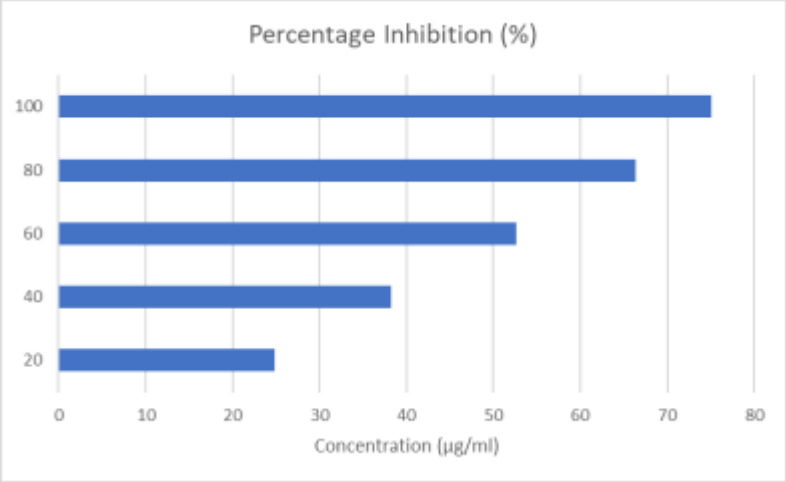
The free radical scavenging action of medicinal plants is significant due to the pivotal role of oxidative stress in the progression of chronic diseases, including diabetes mellitus, cancer, inflammation, and cardiovascular problems.

In-vitro Antidiabetic Activity

The antidiabetic efficacy of Dioscorea bulbifera extract was assessed by an α-amylase inhibition assay. The extract demonstrated concentration-dependent inhibition of the α-amylase enzyme.

Table 8: α-amylase Inhibition Activity of Dioscorea bulbifera Extract

Concentration (µg/ml)	Percentage Inhibition (%)
20	24.8
40	38.2
60	52.6
80	66.4
100	75.1



Graph 4: α-amylase Inhibition Activity

The inhibitory activity progressively intensified with the rising concentration of the extract. The pronounced inhibition at 100 µg/ml signifies the considerable antidiabetic potential of Dioscorea bulbifera extract.

The antidiabetic action may be linked to the presence of steroidal chemicals, glycosides, flavonoids, and phenolic substances that block carbohydrate-metabolizing enzymes and decrease glucose absorption.

Correlation Between Phytochemicals and Biological Activity

The biological activities noted in this experiment may be directly linked to the phytochemical ingredients found in the extract. Flavonoids and phenolic chemicals mostly contribute to antioxidant activity, whilst steroidal compounds and glycosides may be accountable for antidiabetic benefits.

Terpenoids and fatty acid derivatives found using GC-MS analysis may also enhance the anti-inflammatory and antibacterial properties of the extract. The presence of many phytoconstituents suggests a synergistic therapeutic effect of Dioscorea bulbifera.

Table 9: Correlation of Bioactive Compounds with Biological Activities

Bioactive Compound	Biological Activity
Flavonoids	Antioxidant activity
Phenolic compounds	Free radical scavenging
Steroidal compounds	Antidiabetic activity
Terpenoids	Anti-inflammatory activity
Saponins	Antimicrobial activity

The present investigation shown that Dioscorea bulbifera possesses significant therapeutic potential due to its numerous phytoconstituents and powerful biological activities. The hydroalcoholic extraction process effectively extracted active substances from the bulbils.

GC-MS study successfully identified notable bioactive compounds responsible for antioxidant and antidiabetic activities. The extract exhibited considerable free radical scavenging action and α-amylase inhibitory potential, underscoring the plant's therapeutic significance.

The study's results support the traditional medicinal use of Dioscorea bulbifera and suggest that the plant may serve as a promising source of natural antioxidants and antidiabetic agents for future herbal medicine development.

SUMMARY & CONCLUSION

The current study verified that Dioscorea bulbifera is a noteworthy therapeutic plant with substantial phytochemical and biological attributes. The hydroalcoholic extraction procedure was effective for isolating active phytoconstituents from the bulbils. GC-MS analysis effectively identified numerous significant chemicals associated with antioxidant and antidiabetic effects.

The extract demonstrated significant free radical scavenging activity and powerful α-amylase inhibitory capacity, suggesting its potential significance in the control of oxidative stress and diabetes mellitus. The presence of flavonoids, phenolic chemicals, steroids, and terpenoids underscores the therapeutic significance of the plant.

The research empirically substantiates the conventional use of Dioscorea bulbifera and indicates that the plant may represent a viable natural resource for the formulation of herbal therapeutics and subsequent pharmacognostic investigations.

FUTURE SCOPE

Additional research may be conducted to isolate and purify certain bioactive chemicals found using GC-MS analysis. Comprehensive pharmacological and toxicological studies may ascertain the safety and therapeutic efficacy of Dioscorea bulbifera. In vivo and clinical research may be conducted to thoroughly assess its antidiabetic and antioxidant properties.

The plant may be further investigated for the development of herbal goods, nutraceuticals, and phytopharmaceutical formulations. Advanced analytical methodologies, including HPLC, FTIR, and LC-MS, may be employed for comprehensive characterization and standardization of the plant extract.

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