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Evaluation of Antioxidant Activity Gomphrena Celosioides Leaf Extract by Using Scavenging Methods

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Keywords

Gomphrena celosioides, anti-oxidant, scavenging assay, DPPH, Ascorbic acid

Abstract

Aim: In the current in vitro study, the antioxidant potential of Gomphrena celosioides leaf extract was evaluated by using the hydrogen peroxide scavenging method and the DPPH radical scavenging Method. **Study design:** Experimental laboratory-based in vitro study. **Method:** Extraction and Investigation of Gomphrena celosioides leaf was done for different phytochemical constituents, and the Antioxidant potency was examined by using the hydrogen peroxide scavenging method (absorbance measured at 230 nm) and the DPPH radical scavenging method (absorbance measured at 517 nm). Percentage inhibition, minimum inhibition, maximum inhibition, and IC50 values were calculated. **Results:** Phytochemical investigation shows the presence of resins, carboxylic acid, steroids, saponin, and alkaloids; thus, all phytochemical constituents have a certain degree of antioxidant activity by donating the hydrogen atom to the free radicals and neutralizing them. The results confirm that the ethanolic extract of Gomphrena celosioides leaf has a dose-dependent antioxidant property. And the IC50 value suggested the extract had moderate to strong antioxidant properties. **Conclusion:** Here, the ethanolic extract of Gomphrena celosioides leaf exhibits moderate to strong antioxidant activity that has been consistently attributed to the presence of phytochemical constituents like resins, carboxylic acid, steroids, saponin, and alkaloids.

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1. Introduction

Oxidative stress is an imbalance of harmful free radicals and antioxidants present in the body. That excessive oxidative stress leads to cellular damage, inflammation and various disease conditions like diabetes, hyperlipidemia, Alzheimer's and cancer [1]. Antioxidants are chemical entity that donates electrons to the free radicals and stabilize them from damaging DNA, lipids and proteins. And the Higher the consumption of antioxidant-rich products or foods that significantly reduce the hyperlipidemic risk by inhibiting the Inhibition of oxidative modification of LDL cholesterol. Hyperlipidemia, also known as Dyslipidemia, the level of cholesterol or triglyceride-rich lipoproteins in the blood is increased. Excess levels of fats (lipids), like cholesterol and triglycerides. It is a significant risk factor for cardiovascular diseases, including coronary artery disease, stroke, and peripheral artery disease [2]. Based on the Causing Factor, hyperlipidemia is classified as Primary (Familial: hyperlipidemia) and Secondary (Acquired hyperlipidemia) [3].

Generally, the hyperlipidemia condition does not show any symptoms in early stages; it can only be discovered by the routine examination of blood cholesterol level or otherwise identified at the severe stage, like a Heart attack or stroke. In some cases, the swelling of the liver, pancreas and blockage of blood vessels occur [4]. The high cholesterol level in the body may be elevated by disease conditions like kidney disease, polycystic ovarian syndrome, and high estrogen levels [5]. Hyperlipidemia is the main risk factor for various cardiovascular diseases conditions [6].

Currently, synthetic anti-hyperlipidemic drugs like HMG CoA reductase inhibitors, Bile acid binding agents, and Fibrates are available for the treatment of

hyperlipidemia. But thus, all have some limitations and that drugs produce some undesirable side effects, like Muscle damage, Liver enzyme elevation and some GIT problems also [7]. Although synthetic and semisynthetic drugs are available, they often produce undesirable side effects, and some newer drugs are expensive, leading to increased interest in traditional medicinal plants as alternative therapeutic agents [8]. Gomphrena Celosioides, a plant with a rich history of traditional use, exhibits anti-inflammatory, antimicrobial, and nephroprotective properties. Our plant Gomphrena closoides comes under the Amaranthaceous family, which is distributed in widely distributed in Asia, Africa and Australia [9].

Figure 1: Whole plant of Gomphrena celosioides Mart.

Figure 2: Leaf and flowers of Gomphrena celosioides Mart.

Gomphrena celosioides is an annual herb plant native to South America but now widely distributed in tropical and subtropical regions. Figure 1 and Figure 2 shows that the gomphrena celosioides are features with woody, stems that are hairy, leaves that are oblong- elliptic and flowers are white/pinkish in nature [10]. The roots are get thickened over the time periods [11]. Gomphrena celosioides synonyms is Gomphrena decumbens Jacq [12].

2. Materials and Methods

2.1 Plant Material Collection and Extraction

Fresh leaves of Gomphrena celosioides were collected and shadow-dried, then the dry leaves were powdered. Then the powder plant material was extracted by using ethanol, the extract was stored and used for further experimental procedures.

2.2 Phytochemical Screening

Various phytochemical screening tests were conducted on the plant extract to identify the presence of major secondary metabolites. Thus, phytochemical test is conducted to check the presence of Alkaloids, Flavonoids, Resins, glycosides, phenolic and sulfur-containing compounds in our plant extract. The Phytochemical constituents are the fingerprint of the

plant materials, and that suggests the biological and pharmacological activity of the plant material. The medicinal properties of the plants depend upon the phytochemical constituents present and much percentage present in the overall yield [13].

2.3 Hydrogen Peroxide Scavenging Assay

In this antioxidant assay method, the chemical compound Hydrogen peroxide is used as a free radical-producing agent. The plant extract was prepared at different concentrations to measure the dose-dependent free radical scavenging potency. The extract was allowed to react with the freshly prepared hydrogen peroxide solution. Then the reaction mixture is incubated for 10 minutes at room temperature in a dark place. The ascorbic acid is used as a standard compound. After the incubation period, the absorbance was determined by using a UV-Visible spectrophotometer at 230 nm [14].

$$\text{Percentage inhibition} = \frac{(\text{absorbance of control} - \text{absorbance of reaction mixture})}{\text{absorbance of control}} \times 100$$

2.4 DPPH Radical Scavenging Assay

In this antioxidant assay method, the chemical Compound 2,2-diphenyl-1-picrylhydrazyl is used as a Free radical-producing agent. The plant extract was prepared at different concentrations from the minimum concentration to the maximum concentration to check the free radical reducing capacity of the extract at different concentrations. The extract is allowed to react with the freshly prepared DPPH solution, then the reaction mixer is incubated for 30 minutes at room temperature in the dark. Here, the ascorbic acid is used as a standard free radical reducing agent. After incubation, the absorbance was measured by using- UV-Visible spectrophotometer at 517nm. The percentage of DPPH scavenging activity was calculated by using the following formula [15].

$$\text{Percentage inhibition} = \frac{(\text{absorbance of control} - \text{absorbance of reaction mixture})}{\text{absorbance of control}} \times 100$$

For both the hydrogen peroxide scavenging assay method and the DPPH scavenging assay method, the IC50 value was calculated to measure the amount of extract required to scavenge 50% of the DPPH radical and hydrogen peroxide present in the reaction mixture. The concentration response curve was plotted by using the results to measure the dose-dependent antioxidant potency of the extract [16], [17], [18], [19], [20].

3. Results

3.1 Phytochemical Screening

The phytochemical profile of the plant extract revealed the presence of several bioactive metabolites. From the phytochemical investigation results, the major quantities of resins, alkaloids, saponins and carboxylic acid are identified, and the trace amounts of steroids are also identified. All the above-mentioned phytochemicals have the capacity to donate electrons to the free radical moiety and neutralize them. They exhibit antioxidant activity by reducing oxidative stress through the modulation of the oxidative pathway.

3.2 Hydrogen Peroxide Scavenging Assay

The ethanolic extract of Gomphrena celosioides leaf extract was evaluated for its Hydrogen peroxide scavenging activity and compared with Ascorbic acid, as a standard antioxidant. demonstrate that the extract exhibits a concentration-dependent inhibitory effect. At 10 µg/ml of ethanolic extract, it shows 42.46 % inhibition, and it gradually increases by increasing the concentration of the extract. Here, 500 µg/ml of Ethanolic extract shows 79.55 % inhibition. The results show that the Gomphrena celosioides leaf extract possesses strong anti-oxidant activity by reducing the free radical, but it is less potent than ascorbic acid. In comparison, Ascorbic acid exhibits significantly higher antioxidant property in comparison to our plant extract.

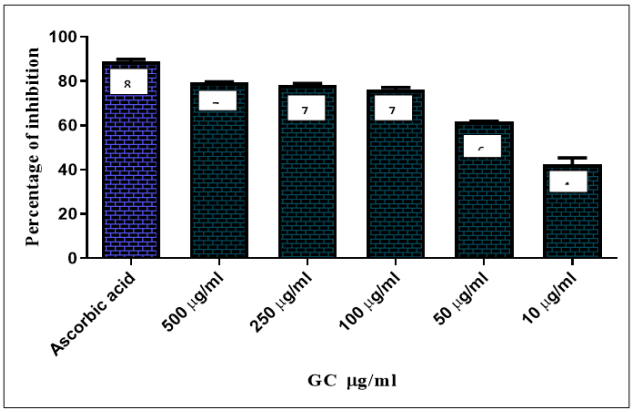

Figure 3: Percentage inhibition Graph – Dose dependent antioxidant activity by Hydrogen peroxide scavenging assay (Absorbance measured at 230nm).

The antioxidant property of the extract was evaluated by the DPPH radical scavenging assay method against Ascorbic acid, as a standard antioxidant. The results observed in Figure 4 demonstrate that the extract exhibits a concentration-dependent inhibitory effect. At 10 µg/ml of ethanolic extract shows 59.02% inhibition, and it gradually increases with increasing concentration of the extract. The ethanolic extract at 500 µg/ml shows 71.77% inhibition, and the IC_{50} value of the extract is 98.94 µg/ml, indicating that our plant extract exhibits moderate antioxidant properties. Ascorbic acid exhibits significantly higher antioxidant properties in comparison to all other concentrations of the extract. It confirms our extract can donate an electron to reduce the free radicals present in the DPPH solution.

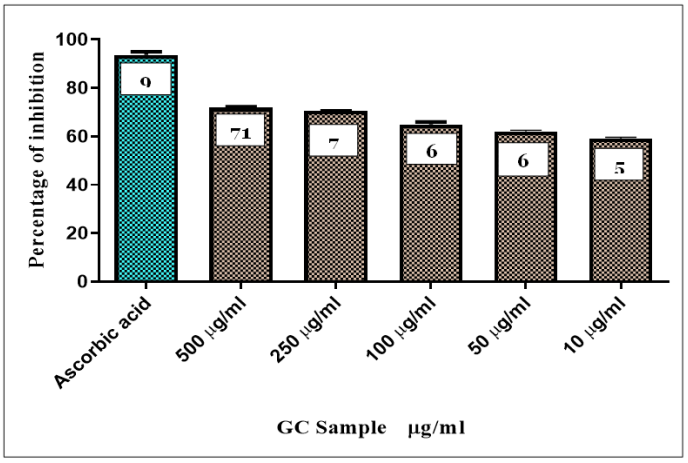

Figure 4: Percentage inhibition Graph – Dose dependent antioxidant activity by DPPH radical scavenging assay (Absorbance measured at 517nm).

4. Discussion

The antioxidant property of Gomphrena celosiodes is evaluated in the present study by the qualitative phytochemical screening method and free radical scavenging assay methods. The phytochemical profile of the extract shows the presence of bioactive compounds, resins, alkaloids, saponins, carboxylic acid and trace amounts of Steroids. Thus, bioactive compounds act individually or by acting together to produce antioxidant activity due to their neutralizing ability or electron transfer mechanism or donation of electrons [20].

The scavenging methods are widely accepted and reliable methods for evaluating the antioxidant potential. These scavenging methods result based on the dose-dependent inhibition of the extract. The results from the Hydrogen peroxide scavenging assay and DPPH radical scavenging assay show dose-dependent antioxidant property by the percentage inhibition of the free radical in the absorbance. That indicates our plant extract has a notable antioxidant property, also proved by the IC50 value of both the scavenging assay method results. The antioxidant ability of the extract may be attributed to its ability to scavenge free radicals, reduce oxidative stress and interact ability on biological membranes. Further isolated compound study is required to confirm the antioxidant property of the individual phytochemical compounds. The isolated compound exhibits the more reliable and accurate results [21,22].

5. Conclusion

The present study revealed the significant antioxidant properties of Gomphrena celosioides leaf extract, attributed by the presence of bioactive metabolites such as alkaloids, saponins and carboxylic acid. The extract showed the concentration dependent inhibitory effect on hydrogen peroxide scavenging assay and DPPH radical scavenging assay with the IC50 value indicating moderate antioxidant activity. The plant containing the carboxylic acid showed higher antioxidant potency by scavenge free radical and reduce oxidative stress and it suggest the potential as a natural antioxidant. Isolation and characterization of individual phytochemical constituents further warranted to elucidate their contribution of the individual compounds on antioxidant effect. Thereby Gomphrena celosioides as a promising candidate for managing oxidative stress related disorders and lipid metabolism dysregulation. The antioxidant activity can contribute to anti-hyperlipidemic activity by Reducing oxidative stress, Enhancing the activity of enzymes involved in lipid metabolism and inhibiting the formation of pro-inflammatory mediators.

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Author Contributions

JE; Experiment design and execution of research work, HP; Data analysis and interpretation, SK; Manuscript preparation and BS; Supervision and final approval.

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Not applicable

Conflict of Interest
There are no conflicts of interest.

Declaration
The author acknowledges the use of AI-powered language tools (ChatGPT and Grammarly) to enhance clarity and readability of the manuscript. The generated content is carefully reviewed and edited by the author to ensure the alignment, validation, and accuracy of the content for the intended meaning of the research.

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