

PHYTOCHEMICAL ANALYSIS AND ANTI OXIDANT ACTIVITY OF *ALLIUM CEPA* L.

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Received: 5/3/2024

Revised:22/5/2024

Accepted:25/5/2024

Published: 30/12/2024

Abstract

The present explores the phytochemical composition and antioxidant potential of onion bulbs (*Allium cepa*). Qualitative analysis of the ethanolic extract identified seven bioactive compounds, including proteins, terpenoids, coumarins, alkaloids, flavonoids, carbohydrates, and phenolic compounds. The ethanolic extract showed the highest antioxidant activity in the DPPH radical scavenging assay, with a scavenging rate of 80.28%, comparable to ascorbic acid. These findings highlight Onion's strong antioxidant properties, supporting its potential therapeutic use in conditions related to oxidative stress. The study also emphasizes the importance of phytochemical screening in developing new medicinal agents.

Key words: Phytochemical, Coumarins, Alkaloids

Introduction

Throughout the ages, humans relied on nature for their basic needs for the production of foodstuffs, shelters, clothing, transportation, fertilizers, flavours, fragrances, and, not the least, medicines. Plants are used as an important source of life saving drugs from time immemorial. Plants have formed the basis for the traditional medicine systems that have been in existence for thousands of years and continue to provide mankind with new remedies (Sharma and Dubey, 2011). Nature has been a source of many medicinal agents and an impressive number of modern medicines were isolated from natural sources. Most of these isolations were based on the uses of the agents in traditional medicine (Farombi, 2003). The plant-based, traditional medicine systems continue to play an important role in health care, about 80% of the world's population relying mainly on the traditional medicines for their primary health care (Owolabi *et al.*, 2007). World Health Organization (WHO, 2000) defined “a medicinal plant” is any plant, in which its one or more plant parts contains substances which can be used for the various therapeutic purposes or which, are pre-

cursors for the synthesis of useful drugs.

The plants provide foodstuff, attire, shelter and medicine. Most of the herbal benefits seem to have been developed through observation of wild animals and by trial and error methods. As time goes on, people started to find and to utilize more herbs having medical power. They systematically brought together information on herbs and developed to well-defined herbal pharmacopoeias *i.e.* traditional medicinal system. Traditional use of medicine is identified as a way to learn about potential future medicines. Because of wide biological and medicinal values high safety margins and lesser cost of herbal medicine, it has great demand and used as source of basic health care in both developed and developing countries (Kamboj, 2000).

For this study, *Allium cepa*, commonly known as onion, has been selected due to its widespread cultivation, nutritional value, and significant presence in both culinary and medicinal contexts, making it a relevant subject for further exploration. *Allium cepa*, or onion, is a perennial herb with an underground bulb and belongs to

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the Liliaceae or Alliaceae family. It grows flower stalks up to 180 cm tall and is commonly cultivated from small seeds. Onions, valued for their flavor and nutrition, are often stored as pickles. Originating in regions like Afghanistan, Iran, and the USSR, they are now grown in over 175 countries, with about 90% water content and high dietary fiber and sugar. The study aims to investigate the phytochemical screening and antioxidant activities of *Allium cepa*.

Materials and Methods

Sample collection

For the present study, onion bulbs were collected from a local market near Sree Narayana College, Chempazhanthy. The bulbs were carefully washed under running water to remove any impurities, and the outer layers of both the onion were peeled off before being washed again.

Preparation of plant Extract

i) Aqueous extract

The 100 mg bulbs were cut the small pieces and was made into a crude paste. The paste was soaked in 100 ml of sterile distilled water for 72 hours at 40°C and it was then filtered thrice using a sterile muslin cloth. The filtrate was poured into a beaker and concentrated on a water bath at 100°C to obtain semi-solid residues and they aqueous extract was weighted and this was immediately subjected to preliminary phytochemical and antioxidant analysis using standard method.

ii) Ethanolic extract

After cleaning 100 mg of onion as described earlier they were made into a paste was soaked in 100ml of ethanol for 72 hours at room temperature than it were filtered using sterile muslin cloth and the filtrate was poured into a beaker and concentrated on a water bath at 70-80°C to obtain semi-solid residue. The weight of the yield was noted and this was subjected in preliminary phyto-chemical and antioxidant analysis using standard method.

iii) Chloroform extract

After making a paste of 100 mg onion of different varieties as described earlier, they were separately soaked in 100 ml of chloroform for 72 hours at room temperature the filtered using sterile muslin cloth and filtrate was concentrated in a beaker at 60-62°C to obtain semi-solid residue. This have weighted and subjected to preliminary phyto-chemical and antioxidant analysis.(Prakash *et al.*, 2016)

iv) Petroleum ether extract:

Following the earlier procedure, onion bulb of different varieties was prepared and soaked in 100ml of petroleum ether for 72 hours at room temperature. It was filtered and the filtrate concentrated at 40-60°C. The extract was weighted and subjected to preliminary phyto-chemical and antioxidant analysis standard method.

Phytochemical Investigations

Preliminary phytochemical analysis of crude extract of *H.hispidimus* Griff., were carried out according to the standard procedures. In accordance with the established standard procedures, a series of phytochemical tests were conducted to detect the presence of various compounds, including alkaloids, flavonoids, carbohydrates, coumarins, saponins, glycosides, proteins, phenols, and tannins, to evaluate the diverse chemical constituents of the plant materials used in the study.

Antioxidant assay of experimental plant

DPPH free radical Scavenging Assay

Free radical scavenging potential of ethanolic extract of experimental plant sample was determined by 2, 2-diphenyl-1-picrylhydrazyl (DPPH) assay. DPPH is a stable free radical. On accepting hydrogen from a corresponding donor, its solutions lose the characteristic deep purple (λ_{max} 515-517 nm) color. For getting different concentrations, the sample was diluted with 0.2 ml of extract solution in ethanol (95%) at different concentration (20,40,80,160) was added to 8ml of 0.004% (w/v) stock solutions of DPPH in ethanol (95%). The scavenging activity on the DPPH radical was determined by measuring the

absorbance at 517 nm until the reaction reached the steady state, using a spectrophotometer (Mini Spec SI-207, Elico Limited India). As a positive control, ascorbic acid (150 µg/ml) was used. All determinations were performed in triplicate.

The percentage of DPPH radical scavenging activity (S %) was calculated by using the following equation.

$$S \% = (A \text{ control} - A \text{ sample}) / A \text{ control} \times 100$$

A control is the absorbance of the blank control (containing all reagents except the extract solution). A sample is the absorbance of the test sample.

Results

Phytochemical analysis

Qualitative phytochemical analysis

Phytochemicals literally means plant chemicals. The use of plant medicine holds a great promise as an easily available source and which cure diseases. In the present investigation *Allium cepa* bulbs are analysed their phytochemical characters. Qualitative phytochemical analysis of onion is showed remarkable presence of various phytochemical constituents. The preliminary phytochemical screening of the ethanolic extract of *Allium cepa* bulbs are showed significant results. Among eleven tests analysed the *Allium cepa* showed the presence of seven phytochemical compounds such as Alkaloids, flavonoids, carbohydrates, coumarins, terpenoids, phenolic compounds and proteins. Table 1 show that Flavonoids, Alkaloids and Coumarins are positive for the four extracts and saponins and glycosides are negative.

In vitro Antioxidant studies

DPPH radical scavenging activity

Antioxidants are the substances which inhibit oxidation which have the ability to remove the potentially damaging oxidizing agents in a living organism. Many phytochemicals present in the plants are able to reduce or prevent the oxidative damage to the human cells which can

cause even cancer in humans. It is highly vital to know about the antioxidant activities of each plant and the phytochemicals responsible for that. In our study, the antioxidant activities of the *Allium cepa* L., were analyzed through a standard method, DPPH radical scavenging activity which showed remarkable results.

DPPH (1,1-diphenyl-2-picrylhydrazyl) has been widely used for free radical scavenging assessments due to its ease and convenience. In the present study, ethanolic extracts of *Allium cepa* are exhibited effective scavenging against DPPH radical.

Different extracts of *Allium cepa* are exhibit the scavenging activity. The highest radical scavenging activity was observed at the ethanolic extracts. Antioxidant value was compared with the different extracts and standard used *ie* Ascorbic acid. The standard ascorbic acid shows good scavenging activity, it has some equivalence with the ethanolic extracts of *Allium cepa*. Ethanolic extract of *A. cepa* is exhibited most scavenging effect with the value of 80.28% in the ethanolic extract (Table 2).

Table 1. Qualitative phytochemical analysis of *Allium cepa* L.

SL No.	Phytochemicals	PE	CHL	ETH	DW
1	Alkaloids	+	+	+	+
2	Flavonoids	+	+	+	+
3	Carbohydrates	-	+	+	-
4	Coumarins	+	+	+	+
5	Glycosides	-	-	-	-
6	Saponins	-	-	-	-
7	Proteins	+	-	+	-
8	Phenols	+	+	+	+
9	Terpenoids	+	-	+	-

“+” present;“-“Absent; PE- petroleum ether; CHL- Chloroform; ETH-Ethanol; DW- Distilled water

Table 2. DPPH free radical scavenging activity of different extracts of *Allium cepa* L.

Sl. No.	Concentration ($\mu\text{g/ml}$)	97.08 \pm 0.18			
1	Control Ascorbic acid (100)				
		PE	CHL	ETH	DW
2	20	1.16 \pm 0.02	5.01 \pm 0.02	17.06 \pm 0.02	10.06 \pm 0.02
3	40	15.13 \pm 0.004	18.17 \pm 0.004	35.03 \pm 0.004	25.03 \pm 0.004
4	80	35.28 \pm 0.01	38.03 \pm 0.01	65.23 \pm 0.01	45.23 \pm 0.01
5	100	60.01 \pm 0.01	66.28 \pm 0.01	80.28 \pm 0.01	68.28 \pm 0.01

Discussion

Phytochemicals are naturally occurring compounds in plants, with medicinal plants being rich in bioactive substances that play a key role in disease prevention. Traditional herbal medicines, passed down through generations, have gained attention for their therapeutic potential and as sources of novel drugs with specific chemical constituents. Medicinal plants contain an array of therapeutically active ingredients. knowledge of these chemical constituents plays an important role in evaluating its pharmacological activity. The therapeutic efficacy of traditionally used medicinal plants is mainly due to the phytochemicals present in them and these phytochemicals is mostly secondary metabolites such as alkaloids, tannins and total phenolics etc.

Phytochemical screening of plants is the need of the hour in order to discover and develop novel therapeutic agents with improved efficacy. Among all the phytoconstituents, phenolics compounds are one of the largest and most ubiquitous groups of plant metabolites (Singh *et al.*, 2007). Comparative preliminary phytochemical analysis of various fractions and crude extract of *Allium cepa* showed rich in bio-constituents.

The phytochemical screening in the present, study, has revealed the presence of terpenoids, steroids, glycosides, flavonoids, tannins, carbohydrates and coumarins in the bulbs extract. Further the presence of different phytoconstituents in the four different extracts may be responsible for the therapeutic properties of onion. Comparatively ethanolic extracts of *A. cepa* contain more phyto constituents. Similarly

reported that onion contain bioactive compounds such as organosulfur compounds, saponins, phenolic acids, flavonoids and polysaccharides (Diretto *et al.*, 2017; Szychowski *et al.*, 2018; Bradley *et al.*, 2016; Wang *et al.*, 2018), The DPPH radical scavenging assay is used for evaluation of antioxidant potential of natural products because of its stability in the radical form, accuracy and simplicity of the assay. In the radical form, DPPH disappears, on reduction by an antioxidant compound or a radical species to become a stable diamagnetic molecule resulting in the colour change from purple to yellow, due to the formation of diphenyl picryl hydrazine (DPPH), which could be taken as an indication of the hydrogen donating ability of the tested samples (Oktay *et al.*, 2003; Lee *et al.*, 2012). The present study reveals the ethanolic extract of *A. cepa* is showed highest DPPH radical scavenging activities. The result indicates that the plant extracts with their proton donating ability, could serve as free radical inhibitors or scavengers, acting possibly as primary antioxidants. The high antioxidant activity of Alliums and especially high RAS of garlic were reported by numerous investigators (Velioglu *et al.*, 1998;

Conclusion

In conclusion, the phytochemical examination of the onion, *Allium cepa*, showed the existence of a number of bioactive substances, such as proteins, terpenoids, coumarins, alkaloids, flavonoids, and phenolic compounds. According to these results, onion bulbs have a wide variety of phytochemicals that could enhance their medicinal properties. The ethanolic extract of

Allium cepa exhibited significant antioxidant activity and a remarkable scavenging power comparable to that of ascorbic acid, as further evidenced by the DPPH radical scavenging assay. These findings demonstrate onions' promising antioxidant qualities, which may be explained by the phytochemicals found in their extracts. The work supports the use of *Allium cepa* in traditional medicine and its potential for pharmacological uses in the future by highlighting the significance of phytochemical screening in the identification and development of novel therapeutic agents.

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