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Antioxidant Potential of Most Commonly Used Vegetable - Onion (*Allium cepa* L.)

Gunpreet Kaur[1], Vikas Gupta[1], Ajay Francis Christopher[1] and Parveen Bansal[1*]

[1]University Centre of Excellence in Research, BFUHS, Faridkot, India.

Authors' contributions

This work was carried out in collaboration between all authors. Authors GK, VG and PB designed the experiments and wrote the first draft of the manuscript. Authors GK, VG, AFC and PB performed all the scientific experiments and typed the manuscript. All authors read and approved the final manuscript.

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Short Communication

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ABSTRACT

Antioxidants are known to play a vital role in inhibiting and scavenging free radicals, thus, provide immunity to human body against various infections and chronic diseases. Nowadays the modern research is moving towards plant based "Natural antioxidants" due to their safety, easy availability and better curative value. So the main reason of the present study was to assess the *in-vitro* antioxidant activity of the extracts of *Allium cepa* which is a very commonly used food worldwide.
Aim: Estimation of *in-vitro* antioxidant activity of the *Allium cepa* extract.
Study Design: Red onions were purchased from the market, washed in water to remove the dust and then dried for 20 days. The methanol and aqueous extracts of the bulb were prepared and investigated for their antioxidant activity.
Methodology: The methanol and aqueous extracts of the bulb were prepared and investigated for their antioxidant activity by using $FeCl_3$, DPPH, Superoxide scavenging and FRAP methods. The total phenolic content was determined by Folin-Ciocalteu reagent.
Results: The total phenolic content showed a higher value (47 mg/100 ml) in the aqueous extract compared to (41 mg/100 ml) in the methanol extract. The antioxidant activity of aqueous extract by using $FeCl_3$, DPPH, Superoxide scavenging and FRAP methods were found to be 13.1%, 23%, 33%, 21.7% and that of methanol extract were 17.5%, 35.5%, 37.8%, 38.7% respectively.
Conclusion: From the above study it has been concluded that, both extracts showed an important antioxidant activity. However the methanol extract proved to have higher antioxidant activity. It was

**Corresponding author: E-mail: bansal66@yahoo.com, ucer_bfuhs@rediffmail.com;*

further observed that the phenolic content was higher in the aqueous extract of *Allium cepa*. Further study will be conducted to isolate the active components responsible for the activity.

Keywords: Onions (Allium cepa); vegetables; extractions; phenolics; antioxidants.

1. INTRODUCTION

The human body needs energy as well as immunity from dreaded diseases. This energy and immunity is derived mainly from components of food items consumed from time to time. One of the important components providing immunity is antioxidants as they prevent oxidative stress damage [1,2]. Antioxidant status of the body depends on the amount of antioxidant generating foods consumed by an individual. Foods includes cocktail of vegetables, fruits, minerals, vitamins that contribute to the antioxidant status of the body. Since- vegetables are an important part of the daily diet; it is pertinent to focus on common vegetables daily consumed by individuals [3].

Onion is one such component which is used as a food component in one or the other form on daily basis by most of the population in India and abroad. It has been reported to contain a high content of flavonoid compounds like quercetin and sulphur compounds like thiosulphinates that have a proven level of antioxidant activity [4-6]. Keeping the above status in view, it was decided to evaluate the antioxidant activity of *Allium cepa* using different methods, so as to highlight the nutritional value of the onion.

2. MATERIALS AND METHODS

2.1 Plant Material

Fresh and healthy red onions bulbs were purchased from the local market in Patiala, Punjab and authenticated by a botanist, in the department of Botany, Punjabi University, Patiala and washed in water to remove the dust and then dried for two hours. The outer covering of the onions was peeled off. All the chemicals were of analytical reagent grade and all the glassware's used were of Borosil grade.

2.2 Preparation of Onion Extract

Peeled onions were washed in water containing Tween-20 solution for 10 minutes and sterilized with 70% ethanol. After a wash with distilled water 2-3 times, surface sterilized onions were cut into pieces and then dried in shade for 20 days. Dried onions were powdered and 200 mg onion powder was then mixed with 50 ml distilled water with intermittent shaking. It was filtered twice with Whatman filter paper no.1 and concentrated to dryness on a water bath at 100℃. Finally, the concentrated extract was collected, covered with aluminium foil and was stored in a refrigerator. Similarly, methanolic extract was prepared using 50 ml methanol [7,8].

2.3 Estimation of Total Phenolic Content

The amount of total phenolic content in samples was determined by using Folin-Ciocalteu reagent as used in the standard method and absorbance was taken on spectrophotometer Labindia UV 3000^+ [9,10]. Gallic acid standard curve was obtained for calculation of total phenolic content [11,12].

2.4 Determination of Antioxidant Activity

The antioxidant activity of each extract was tested using Reduction by $FeCl_3$ done by the method of [13,14] with modifications in volume, DPPH Method (1,1-Diphenyl-2-picrylhydrazyl) by method of [15,16], Superoxide scavenging method (DMSO) by using the method of [17,18] with slight modifications in volume and FRAP Method (Ferric Reducing Antioxidant Power) a modified method of [19,20].

2.5 Scavenging Activity was Calculated by Using Equation [21]

Scavenging activity (%) = Test absorbance - control absorbance / Test absorbance X100

3. RESULTS AND DISCUSSION

3.1 Estimation of Total Phenolic Content

The phenolic content was estimated using the standard curve of Gallic acid. The aqueous extract of *Allium cepa* showed higher antioxidant potential than the methanol extract (Table 1). Antioxidants have a capacity to donate either an electron or hydrogen to cellular molecules

Table 1. Gallic acid equivalent (GAE) phenol content in onion extract

Extract	GAE phenol content (mg/ml)
Aqueous	47±0.003
Methanol	41±0.001

The value is expressed as Mean ± S.E (n=3), S.E= σ/√n, σ= Standard deviation, n= Number of sets

Table 2. Antioxidant activity of onion extracts by using $FeCl_3$, DPPH, DMSO and FRAP methods

S. no	Extract of *Allium cepa*	Free radical scavenging activity represented as (%) inhibition				
		$FeCl_3$ method	DPPH method	DMSO method	FRAP method	Standard (Gallic acid)
1.	Aqueous extract	13.1±0.002	23.0±0.008	33.0±0.001	21.5±0.006	37.2±0.004
2.	Methanol extract	17.3±0.001	35.4±0.005	37.8±0.000	38.7±0.004	43.1±0. 001

The value is expressed as Mean ± S.E (n=3), S.E= σ/√n, σ= Standard deviation, n= Number of sets

oxidized by free radicals and thus help to repair oxidative damage. The activity is dependent on the presence of antioxidants.

3.2 Antioxidant Activity

3.2.1 Reduction by $FeCl_3$

The methanol extract of *Allium cepa* had higher reducing power as it showed a higher absorbance at 700 nm, than the aqueous extract. So, it has more antioxidant capacity as compared to aqueous extract (Table 2).

3.2.2 DPPH method

The methanol extract of *Allium cepa* showed higher DPPH free radical scavenging activity (antioxidant activity) as compared to aqueous extract. Thus, it prevents the formation of free radicals which cause various diseases like cardiovascular, cancer, diabetes etc (Table 2).

3.2.3 DMSO method (Superoxide scavenging activity)

The methanol extract of *Allium cepa* showed more radical scavenging activity than aqueous extract. Thus methanol extract has higher scavenging activity than aqueous extract which ultimately results in prevention of cellular damage by free radicals (Table 2).

3.2.4 FRAP method (Ferric reducing antioxidant power)

The methanol extract of *Allium cepa* showed a higher ability to reduce ferric-tripiridyltriazine (Fe^{3+}-TPTZ) to a ferrous form (Fe^{2+}) than aqueous extract. Hence, the results from methanol extract showed higher antioxidant ability as compared to aqueous extract (Table 2).

4. DISCUSSION

The radical scavenging activity of the methanol extract was in the order as follow:

FRAP method >DMSO method> DPPH method> $FeCl_3$ method. The antioxidant activities observed can be attributed to either the different mechanisms exhibited by different polyphenolic compounds like tocopherols, flavonoids and other organic acids and to the synergistic effects of different compounds. Many studies have shown that many polyphenols contribute significantly to the antioxidant activity and act as highly effective free radical scavengers which are mainly due to their redox properties, which can play an important role in adsorbing and neutralizing free radicals, quenching singlet and triplet oxygen or decomposing peroxides [22]. The lowest activity by $FeCl_3$ method in aqueous as well as methanol extract demonstrates the low capacity of extracts to reduce the Fe (III) to Fe (II) (i.e., reducing power of sample). Thus, the data suggested that the aqueous and methanol extract had not served as a significant indicator to react against free radicals to convert them into more stable non- reactive species and to terminate radical chain reaction [23].

5. CONCLUSION

The present study was conducted to explore the antioxidant properties of *Allium cepa* and the results of the study show that onion is a very potent source of antioxidants and its

consumption should be encouraged by making the people aware of beneficial effects to the system. The above results also show that the methanol extract has higher scavenging activity than aqueous extract but phenolic content was higher in aqueous extract than methanol extract of *Allium cepa.* The study also reflects that $FeCl_3$ should not be used as an assessor for antioxidant activity as it underestimates the antioxidant activity. However to gain an insight on the antioxidant levels and activities in onion, extended efforts on purification, identification and quantification of phenolic and non-phenolic compounds are necessary and important in future.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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