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Determination of Antioxidant Activity of Some Varieties of Onion (*Allium cepa L.*) Grown in Sudan

Nizar Sirag[1], Imad M. Tajeldin[2], Mohamed Abubakr [3*]

[1]*Department of Pharmacognosy, Faculty of Pharmacy, University of Gezira, Sudan, Department of Natural Products and Alternative Medicine, Faculty of Pharmacy, University of Tabuk, KSA.*
[2]*Department of Pharmacology, Faculty of Pharmacy, University of Gezira, Sudan.*
[3]*Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Gezira, Department of Chemistry, Faculty of Science and Arts, University of Bisha, KSA.*
* *Corresponding author. E-mail*: mohammedabubakr20@gmail.com

Abstract. Background: Medicinal plants contain physiologically active ingredients that over the years have been exploited in traditional medicine for the treatment of various ailments.
Objectives: This study was undertaken to investigate the antioxidant activity of seven varieties of onion (*Allium cepa*) grown in Sudan.
Methods: The antioxidant capacity was conducted based on the ability of the plant extracts to scavenge DPPH radical.
Results: The extracts exhibited a notable dose dependent inhibition of DPPH radical. Shendi (Red onion local strain) exhibited the highest antioxidant activity with EC50 25.25 µg/ml followed by Kassala (Red onion local strain) and white onion while less scavenging activity was produced by Green onion.
Conclusion: Based on the results obtained in the present study, it can be concluded that *Allium cepa* grown in Sudan possesses sufficient antioxidant activities. Moreover, the results of the *in vitro* antioxidant assay may coincide with the preference of Sudanese people to red onion grown in North and East Sudan among the other varieties .

Keywords**:** Antioxidant activity; Reactive Oxygen Species; *Allium cepa*.

Introduction

Since very old times, herbal medications have been used for relief of symptoms of diseases [1]. Despite the great advances observed in modern medicine; plants still make an important contribution to health care. Much interest, in medicinal plants, however, emanates from their long use in folk medicines as well as their prophylactic properties, especially in developing countries. Large number of medicinal plants has been investigated for their antioxidant properties. Natural antioxidants either in the form of raw extracts or their chemical constituents are very effective to prevent the destructive processes caused by oxidative stress [2]. Although the toxicity profile of most medicinal plants have not been thoroughly investigated, it is generally accepted that medicines derived from plant products are safer than their synthetic counterparts [3]. Substantial evidence has accumulated and indicated key roles for reactive oxygen species (ROS) and other oxidants in causing numerous disorders and diseases. The evidence has brought the attention of scientists to an appreciation of antioxidants for prevention and treatment of diseases, and maintenance of human health [4]. Human body has an inherent antioxidative mechanism and many of the biological functions such as the antimutagenic, anti-carcinogenic, and anti-aging responses originate from this property [5]. Antioxidants stabilize or deactivate free radicals, often before they attack targets in biological cells [4]. Interest in naturally occurring antioxidants has considerably increased for use in food, cosmetic and pharmaceutical products, because they possess many effects and provide enormous scope in correcting imbalance [6]. The role of free radical reactions in disease pathology is well established and is

known to be involved in many acute and chronic disorders in human beings, such as diabetes, atherosclerosis, aging, immunosuppression and neurodegeneration [4]. An imbalance between ROS and the inherent antioxidant capacity of the body, directed the use of dietary and /or medicinal supplements particularly during the disease attack. Studies on herbal plants, vegetables, and fruits have indicated the presence of antioxidants such as phenolics, flavonoids, tannins, and proanthocyanidins [7].

Onion (*Allium cepa* L) is a common food plant rich in several phytoconstituents associated with the treatment and prevention of a number of diseases. Extracts of red onion rich in phenolic compounds exhibit antiproliferative activity, antimutagenic properties, anticancer, antiulcer, antispasmodic and antidiarrheal activities [8]. In Egypt , Elhassaneen and Sanad[9] reported that phenolic compounds besides other elements such as selenium, vitamin C and sulfur containing amino acid play an important role in the antioxidant capacity of onion bulbs. They found that Egyptian red onion had better antioxidant activity while white onion was only effective at the early stage of oxidation process. Moreover, they attributed the low scavenging activity of green onion to the least phenolic content compared to other varieties, red, yellow and purple.

Onion (*Allium cepa* L) is a popular plant widely used by virtually every global nations and as it is being edible and with no apparent adverse effects. It can play an important role in solving such health problems as well as a potential source of bioactive medicines. Hence, this study aimed to investigate the antioxidant capacity of seven varieties of onion grown in Sudan with respect to the main cultivating and producing areas.

Materials and Methods

Materials

Chemicals and Reagents:

2, 2 diphenyl-2-picryl hydrazyl (DPPH) and quercetin were purchased from Sigma –Aldrich company (UK).

Plant Materials:

Three types of red fresh bulbs of *Allium cepa* whose seeds were indigenous to and cultivated in Sudan were purchased from the local market in Wad-Medani city (Central Sudan), Shendi city (North Sudan) and Kassala city (East Sudan). Two varieties of red onion of imported seeds which were cultivated in Sudan were purchased from the same markets. The remaining varieties of green and white onion were purchased from Wad-Medani market. The plant materials were identified by the Department of Pharmacognosy, Faculty of Pharmacy, University of Gezira, Sudan.

Methods

Extraction of plant material:

First the plant materials were cut into small slices, dried and each sample was weighed using electronic sensitive balance (Adventurer OHAUS,USA). One hundred grams of each coarsely powdered bulbs of *Allium cepa* were separately extracted by maceration using ethanol (70%) in a conical flask for 72 hours in dark, filtered and evaporated by a rotary evaporator at 60 ^{o}C. The resulting solutions were dried and kept in a refrigerator until use [7].

Antioxidant activity of Allium cepa ethanolic extracts:

Sample stock solution (1 mg/ml) was diluted to final concentrations of 250, 125, 50, 10 and 5 µg/ml in ethanol. One ml of a 0.3 mM 2,2 diphenyl-2-picryl hydrazyl (DPPH) in ethanol solution was added to a 2.5 ml solution of the different concentrations of the extracts and allowed to react at room temperature for 30 minutes. The absorbance of the resulting mixture was measured at 518 nm and converted to percentage antioxidant activity (AA %), using the formula below:

$$AA\% = \frac{\text{(Absorbance of control – Absorbance of sample)}}{\text{Absorbance of control}} \times 100$$

Ethanol (1.0 ml) plus plant extract solution (2.5 ml) was used as a blank. DPPH solution (1.0 ml; 0.3 mM) plus ethanol (2.5 ml) was used as control. Stock solution (1 mg/ml) of quercetin was diluted to final concentrations of 250, 125, 50, 10 and 5 µg/ml in ethanol used as positive control [10].All experiments were done in triplicates .

Results and Discussion

The capacity of scavenging diphenyl picryl hydrazine (DPPH) by the ethanolic extract of *Allium cepa* bulbs is presented in Table 1. The antioxidant molecules that can quench DPPH free radicals and convert them to colourless product; resulting in a decrease in UV absorbance [10, 11] In this quantitative assay the extracts exhibited a notable dose dependent inhibition of the DPPH activity. Shendi (red onion local strain) exhibited the highest antioxidant activity at the five concentrations with EC_{50} 25.25 µg/ml followed by Kassala (red onion local strain) and the

white onion while less scavenging activity was produced by the green variety. One parameter that has been used for the interpretation of the results from the DPPH method is the "efficient concentration" or EC_{50} value (otherwise called the IC_{50} value). This is defined as the concentration of antioxidant that causes 50% loss of the DPPH activity (colour). The higher the antioxidant activity, the lower is the value of EC_{50} [12].

Table 1: DPPH scavenging activity of onion varieties.

Preparation	**% scavenging activity**					**EC_{50} (µg/ml)**
	250 µg/ml	**125µg/ml**	**50 µg/ml**	**10 µg/ml**	**5 µg/ml**	77
Gezira (red onion local strain)	88.9	69.3	35.7	16.2	7.6	
Gezira (red onion imported strain)	87.6	69.8	41.5	31.3	15.1	72
Kassala (red onion local strain)	88.1	70.5	55.4	22	8.2	30
Shendi (red onion local strain)	88.7	81.8	58.01	28.3	11.3	25.25
Shendi (red onion imported strain)	90.5	85	65.2	36.2	15.8	52.46
Green onion	78.4	49.1	29.1	12.4	7.2	141.56
White onion	69.2	64.1	46.6	28.3	17.5	69.79
Quercetin	94.7	92.5	90.3	88.6	82.4	5

The historical health benefits of dietary consumption of onions have been attributed to organosulfur compounds such as sulfides and thiosulfinates, as well as flavonoids such as quercetin.They have been the focus of much research pertaining to hypoglycemic, hypolipidemic and antibacterial potentials of onions [13] and antioxidant activity with

beneficial effects on cardiovascular and immune systems, inflammatory conditions and cancer prevention[8].

The high antioxidant activity of *Allium cepa* was reported by numerous investigators [14-16].

The antioxidant activity of *Allium cepa* bulb could be attributed to the presence of thiosulfinates or related organosulfur components [7]. Flavonoids affect antioxidant capacity to a greater extent, especially quercetin and its glycoside conjugates. The mechanism of action of quercetin includes chelation of transition metal ions, free radical scavenging and inhibition of oxidation [17].

Conclusion

Based on the results obtained in the present study, it can be concluded that *Allium cepa* grown in Sudan possesses sufficient antioxidant activities. Moreover, the results of the *in vitro* antioxidant assay may coincide with the preference of Sudanese people to red onion grown in North and East Sudan among the other varieties.

References:

[1]**Maqsood ,S;Singh, P; Samoon, MH; Balange** A.K**,.** Effect of dietary chitosan on non-specific immune response and growth of Cyprinus carpio challenged with Aeromonas hydrophila. *International AquaticResearch*, **2**:77–85**,** (2010)

[2]**Zengin ,G; Cakmak ,YS; Guler ,GO; Aktumsek** A**,** ,Antioxidant properties of methanolic extract and fatty acid composition of Centaurea urvillei DC. subsp. hayekiana Wagenitz. *Rec Natural Products* , **5**:123–132 (2011). .

[3]**Oluyemi, K.A; Okwuonu ,U.C;Baxter, D.G; Oyesola T.O**,Toxic effects of methanolic exract of Aspilia africana leaf on the estrous cycle and uterine tissues of Wistar rats. *International Journal Morphology*, **25**:609–614 **(**2007**).**

[4]**Naima ,S ; Muhammad, R and Maria, S** Antioxidant activity, total phenolic and total flavonoid contents of whole plant extracts *Torilis leptophylla* L. Complementary and Alternative Medicine, **12**:221-233 **(**2012**)**.

[5]**Gulcin, I.** Antioxidant activity of food constituents: an overview. *Achieves of Toxicology* , 86:345–391**(**2012**)**.

[6]**Wannes, WA; Mhamdi, B; Sriti, J; Jemia, MB and Ouchikh, O.,** Antioxidant activities of the essential oil and methanol extracts from myrtle (Myrtus communis var. italica L.) leaf, stem and flower. *Food Chemistry and Toxicology*, **48**:1362–1370 **(**2010**)**.

[7]**Benkeblia, N.,** Free-radical scavenging capacity and antioxidant properties of some selected onions (*Allium cepa* L.) and garlic (*Allium sativum* L.) extracts. *Brazilian Archives of Biology and Technology*, ***48***, 753-759 **(**2005**).**.

[8]**Skerget, M L; Majhenie, M; Bezjak,A and Knez,S** , Antioxidant, Radical Scavenging and Antimicrobial Activities of Red Onion (*Allium cepa* L) Skin and Edible Part Extract**s.** *Chem. Biochem. Eng. Q.* **23** (4) 435–444 **(**2009**).** .

[9]**Elhassaneen, YA and Sanad,MI**,. Phenolics, Selenium, Vitamin C, Amino Acids and Pungency Levels and Antioxidant Activities of Two Egyptian Onion Varieties**.** *American Journal of Food Technology*, **4(6):**241-254 **(**2009).

[10]**Mensor, LL; Menezes, FS; Reis, TC and Leitao, S.G,** Screening of Brazilian plant extracts for antioxidant activity by the use of DPPH free radical method. *Journal of Phytotherapy Research*, **15:**127-130 **(**2001**)**.

[11]**Chinedu, P; Esiaba, I; Olusola, A and Adesuyi, A**., Polyphenolic content and antioxidant activity of *Hibiscus sabdariffa* calyx. *Research Journal of Medicinal Plants,* **5** (5):557-566 **(**2011**)**.

[12]**Songklanakarin, M.,** Use of DPPH to estimate antioxidant activity .Journal of Science and Technology, 26 (2**): (**2004**).**

[13]**Noureddine ,B and Lanzotti, V.,** *Allium* Thiosulfinates: Chemistry, Biological Properties and their Potential Utilization in Food Preservation**.** *Food **1(2)**, 193-201***(**2007**).**

[14]**Velioglu, Y. S.; Mazza, G.; Gao, L. and Oomah, B. D.** Antioxidant activity and total phenolics in selected fruits, vegetables and grain products. Journal of Agricultural and Food Chemistry, **46**, 4113-4117 **(**1998**).**.

[15]**Yin, M. and Cheng, W. (1998).**Antioxidant activity of several Allium members. *Journal of Agricultural and Food Chemistry*, **46**: 4097-4101.

[16]**Xiaonan ,L ;Jun ,W; Hamzah, M and Al-Qadiri, C**. Determination of total phenolic content and antioxidant capacity of onion (Allium cepa) and shallot (Allium oschaninii) using infrared spectroscopy. Food Chemistry, **129**:637–644 **(**2011**)**..

[17]**Siti ,F; Othman1, S; Zahir,I and Mustapha S**., Antioxidant Study of Garlic and Red Onion: A Comparative Study. *Pertanika Journal of Tropical and Agricultural Sciences*, **34** (2): 253 – 261 **(**2011**).**

استقصاء النشاط المضاد للأكسدة لأنواع مختلفة من البصل المزروع في السودان

نزار سراج ، عماد تاج الدين و محمد ابوبكر

المستخلص . **خلفية:** تحتوي النباتات الطبية علي مكونات فسيولوجية فعالة أُستخدمت لسنين عدة في الطب التقليدي لمعالجة أمراض مختلفة.

الهدف: أُجريت هذه الدراسة لاستقصاء النشاط المضاد للأكسدة لسبعة أنواع من البصل المزروع في السودان.

الطرق: تم تحديد السعة المضادة للأكسدة اعتماداً علي قدرة المستخلصات النباتية علي كنس جذرdiphenyl-2-picryl hydrazyl (DPPH) الحر.

النتائج: أظهرت المستخلصات تثبيطا معتمدا علي الجرعة لجذر DPPH الحر. أحدث بصل شندي الاحمر المحلي أعلي نشاطاً مضادا للأكسدة وتبعه بصل كسلا الأحمر المحلي والبصل الأبيض بينما وجد أن البصل الأخضر يمتلك أقل نشاطاً.

الاستنتاج: استناداً علي نتائج الدراسة الحالية, يمكن أن نستنتج أن البصل يمكن أن يمثل مصدراً متوقعاً لمواد مضادة للأكسدة, كذلك فإن نتائج الاختبار المضاد للأكسدة ربما تعزز تفضيل الشعب السوداني للبصل الأحمر المزروع في شمال وشرق السودان علي الأنواع الأخرى.