ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Comparative Analysis of Antioxidant Properties of Different Medicinal and Non-Medicinal Plants.

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ABSTRACT

The crude methanolic leaf extracts of *Artemisia annua, Withania somnifera* and *Brassica juncea* was studied to evaluate and compare their antioxidant activity by the using *in-vitro* methods. The extracts was found to contain significant amount of phenols and had high antioxidant potential as found in Folin- Ciocalteau assay, DPPH free radical scavenging assay and β-Carotene bleaching assay. The total phenolic contents of the extracts varied from 53.7 mg/gm in *Brassica juncea* to 69.34mg/gm in *Withania somnifera* and 72.32mg/gm in *Artemisia annua*. The DPPH free radical scavenging activity shows that *Withania somnifera* has 78.18% scavenging effect while *Artemisia annua* and *Brassica juncea* showed 66.7% and 56.36 %respectively. The β-carotene bleaching of these plant extracts showed the presence of significant amounts of antioxidants. The total antioxidant content found in the leaf extracts was found to be 193.6 mg/gm dry weight in *Artemisia annua*, 205mg/gm dry weight in *Withania somnifera* and 78.18mg/gm dry weight in *Brassica juncea*.

Keywords: Antioxidant, DPPH, β-carotene, Bleaching, Phenols

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ISSN: 0975-8585

INTRODUCTION

Large number of human diseases and aging process has been linked with free radicals and related species. More over these species are responsible for oxidation of lipid in foods, thereby forming off flavors and undesirable chemical compounds which might be harmful to health. Disorders like Alzheimer's disease, arthritis, haemorrhoids, Parkinson's disease, rheumatism, heart attack, AIDS, cataract, stroke, cancer aging are all implicated to free radicals. Antioxidants can be of both natural and synthetic origin. The use of synthetic antioxidants like Butylated hydroxylanisol (BHA) and butylated hydroxyltoluene (BHT) have been restricted in many countries as they are unsafe to use and their toxicity is of major concern. Utilization of natural antioxidants from plants does not provoke adverse effects, while synthetic antioxidants are found to induce genotoxic effects [1]. Free radicals have the capacity to damage the biological molecules like proteins, lipids, DNA, carbohydrates etc. Free radicals are also responsible for cellular damage and homeostatic disruption.[2]. Reactive oxygen species have their role in the complications associated with diabetes mellitus and other neurological diseases like Parkinson's disease [3].Natural antioxidants have the property of protecting the human body from the damaging effects of free radicals. Natural antioxidants inhibit the progress of many chronic as well as retard lipid oxidation activity in foods and pharmaceuticals. Out of various natural antioxidants, phenolic compounds are reported to be more active [4]. Human body as a part of general metabolism produces superoxides, peroxyl, hydroperoxyl, alkoxyl which are categorized as free radicals and other reactive oxygen species referred to as ROS. Epidemiological studies proves that ROS are involved in a number of chronic, cardiovascular and neurodegenerative diseases which are due to the oxidative damage on proteins , DNA, lipids and all other cellular and subcellular molecules. Various exogenous factors leads to the excessive generation of ROS in human body leading to oxidative stress because the in built antioxidant system of the body is not efficient to overcome the overpopulated generation of these radicals. So various external antioxidant supplements must be provided to overcome this state of stress[4]. These antioxidants delay and sometimes inhibit cellular damage caused by the free radicals by its scavenging property[5]. The antioxidants act in the defense systems at different levels like preventing radical scavenging, repair and de novo and adaptation [6]. In the present study, antioxidant properties of some plants like *Artemisia annua, Withania somnifera and Brassica juncea* cultivated at Lovely Professional University were carried out.

MATERIALS AND METHODS

Collection of plants

The leaf samples of the medicinal plants *Artemisia annua* and *Withania somnifera* and non medicinal plant *Brassica juncea* were collected from their natural habitats.

Préparation of plant extracts

The methanolic extracts of leaf of *Artemisia annua, Withania somnifera* and *Brassica juncea were* prepared based on the method published by Mansouri , 2005 [7].

Folin-ciocalteu reagent (FCR) Assay

The total phenolic contents was determined by using calorimetrically with the Folin-Ciocalteu (FC) reagent, by a partially modified method of Mansouri , 2005 [7].

DPPH Free Radical Scavenging Assay

The antioxidant activity of the extracts, was determined by (DPPH) free radical, as described by Lee et al. 2007[8]. The Scavenging effect of the selected plants is found using the formula.

$$\text{Scavenging effect } (\%) = 1 - \left[\frac{(\text{Absorbance}(517\text{nm})}{\text{Absorbance control } (517\text{nm})} \right] x100$$

ISSN: 0975-8585

ß-carotene bleaching assay

Total antioxidant activity of plant extracts and standards (vitamin E and BHT) was calculated as per method of [9] and [10] while Antioxidant activity (AOA) was measured in terms of bleaching of β-carotene by using a slightly modified formula from [11].The antioxidant activity(AOA) was calculated as :

$$AOA = 1 - \left[\frac{(A_o - A_t)}{(A_{oc} - A_{ot})} \right] x100$$

A_o and A_{oc} are the absorbance value for sample and control respectively at initial incubation time. A_t and A_{ot} are the absorbance of extract or standards and control at t=120 min.

RESULTS AND DISCUSSION

The total phenolic content was determined and compared with standard gallic acid. The results were expressed in terms of mg gallic acid equivalent per gm dry weight. Total phenolic content is calculated by using the formula, Concentration of test = [Absorbance of test / Slope(m) of the line equation].

This study showed that the selected plants varied significantly in their total phenolic content. The total phenolic content is found to be 72.32 mg/gm in *Artemisia annua*, 69.34 in *Withania somnifera* and 53.7 mg/ml in *Brassica juncea*.

Table 1: Total phenolic concentration in methanolic leaf extracts of selected plant species

Plant	Total phenolic concentration (mg/gm) dry weight	Total antioxidant concentration (mg/gm) dry weight
Artemisia annua	72.32	193.6
Withania somnifera	69.34	205
Brassica juncea	53.7	78.18

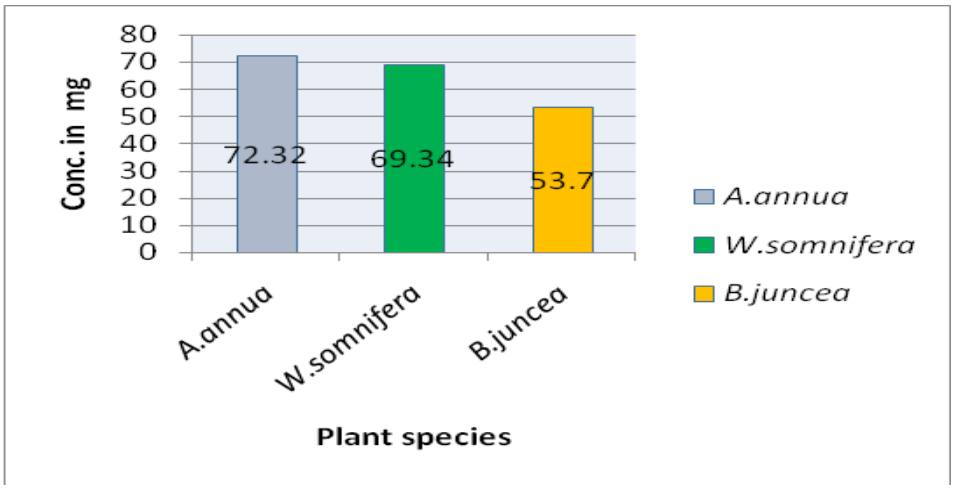

Figure 1: Comparative graph of the total phenolic content of leaf (methanolic extracts)

Plant *Artemisia annua* has the maximum phenolic content while *Withania somnifera* has moderate and *Brassica juncea* which is a non medicinal plant has the least.

ISSN: 0975-8585

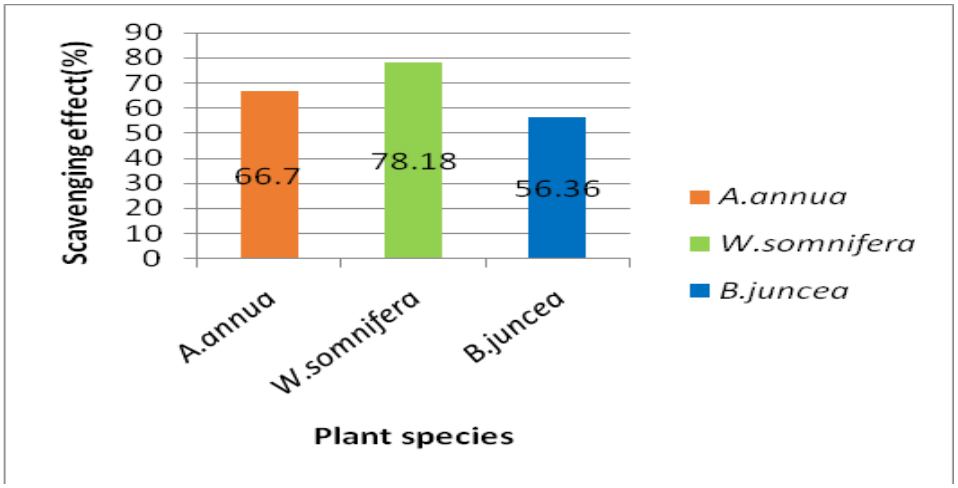

Figure 2: The percentage scavenging activity of methanolic leaf extracts of selected plants

The above bar diagram shows that the comparative scavenging effect of selected medicinal plants. It shows that *Withania somnifera* has the maximum scavenging ability followed by *Artenisia annua* and *Brassica juncea*.

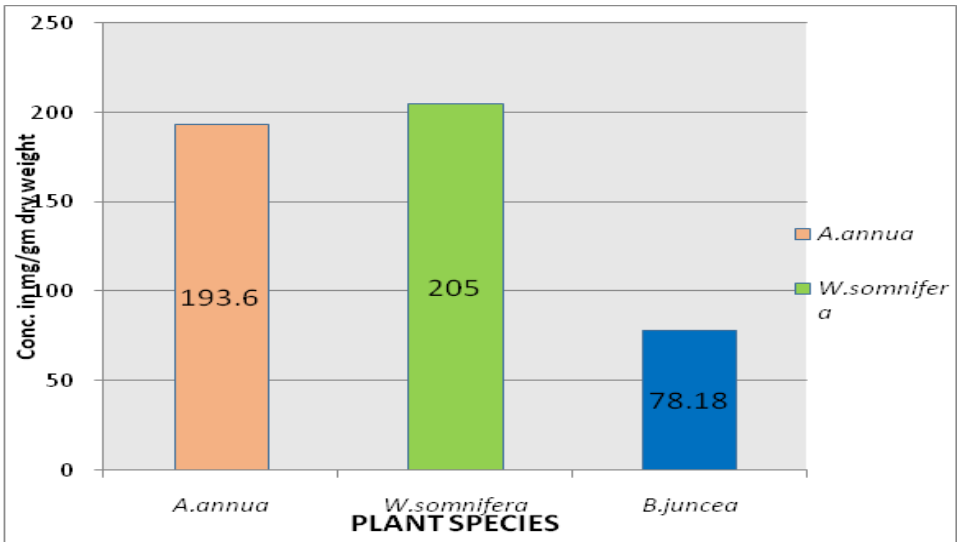

Figure 3: Total antioxidant concentration in leaf extracts of selected plants in mg/gm dry weight

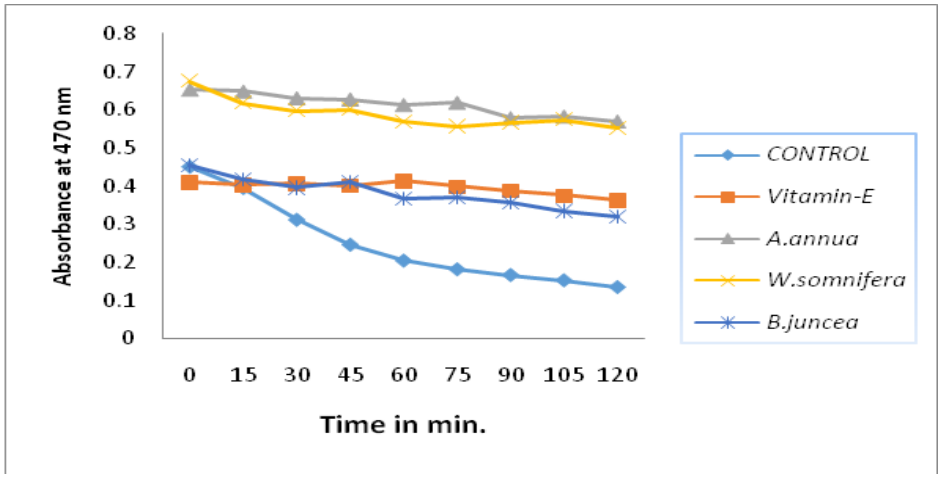

Figure 4: Degradation rate of methanolic leaf extracts of selected plants assayed by β carotene bleaching assay.

The results obtained shows that the control had a substantial and rapid oxidation of β Carotene. Accordingly, as the sample extracts have antioxidants retained their colour and their absorbance for a longer time. The extract of *Artimesia annua* exhibited the highest antioxidant activity since having with lowest β carotene degradation rate. Values were expressed as mean ± standard deviation. Vitamin E were used as standard.

CONCLUSION

This study showed that *Artemisia annua, Withania somnifera and Brassica juncea* possessed varying range of antioxidant activity in methanolic extract. We conclude that methanolic extract of *Brassica juncea* exhibited lower antioxidant activity as compared to other medicinal plants *Artemisia annua* and *Withania somnifera (*Based on total antioxidant and free radical scavenging activities). This study can be further used for the isolation of bioactive compounds from these plants for the discovery of new therapeutic agents.

ACKNOWLEDGEMENT

Author acknowledges the financial support and facility provided by the Department of Biotechnology, Lovely Professional University.

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