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# Antioxidant properties of Moringa (*Moringa oleifera),* Adusa (*Justicia adhatoda),* Beetroot (*Beta vulgaris* L.) and cauliflower (*Brassica olerace*) leaves

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## ABSTRACT

The word "antioxidant" is increasingly popular in modern society as it gains publicity through mass media coverage of its health benefits. Moringa oleifera Lam. (Moringaceae) is a plant that is native to the sub-Himalayan areas of India, Pakistan, Bangladesh, and Afghanistan. As an antioxidant, it helps to protect cells from damage. Justicia adhatoda is a well-known plant used in Ayurvedic and Unani medicine. Beetroot leaves (*Beta vulgaris* L.) are commonly cut off and discarded before using its bulb due to lack of knowledge of how to use them. **Objectives**: To find out the antioxidant properties of moringa (*moringa oleifera),*adusa (*justicia adhatoda),* beetroot leaves (*Beta Vulgaris* L.) and cauliflower leaves (*Brassica oleracea* ). **Research Design**: In this study the selected leaves (Moringa, Adusa, beetroot and cauliflower) are taken from the campus of SHAITS, Allahabad. Leaves were dried by hot air oven drying method. Leaves were kept in an oven for drying at 60º C for 5 hrs and powder were made from dried leaves. Estimation of Photochemical / Antioxidant activity were done by the Total phenol content (TPC), determination of Radical Scavenging Activity, Ascorbic acid content (AAC) and determination of Ferric Reducing Antioxidant Power (FRAP). **Results:** Study showed that the powder obtained from beet root possesses considerable amounts of phenolic compounds and a significant radical scavenging activity towards stable DPPH, antioxidant activity was observed in the cauliflower.

**Key Words :** Moringa (*moringa oleifera),* Adusa (*justicia adhatoda),* Cauliflower (*Brassica oleracea* ), Beetroot (*Beta vulgaris* L.), Antioxidant activity

## INTRODUCTION

The word "antioxidant" is increasingly popular in modern society as it gains publicity through mass media coverage of its health benefits. *Moringa oleifera* Lam. is a small, fast

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growing ornamental plant, which grows up to the height of 10 m in length. It is commonly known as Drumstick in English, Munaga in Telugu, Sahijan in Hindi. It is known as a natural nutrient of tropics (Anwar and Rashid, 2007; Gupta *et al.*, 2010). The leaves of Moringa oleifera possess pharmacological properties such as antidiabetic, antispasmodic, anti-inflammatory, antiparasitic, antianaemic, antiscorbutic, antifertility, anticancer and antiulcer (Singh and Sharma, 2009). It is used for the treatment of infectious diseases, cardiovascular and gastrointestinal problems, hematological and hepatorenal disorders, treatment of mucous membrane, curing diarrhoea, fever, eye and ear infections, bronchitis, diuretic and abortifacient (Nadkarni, 2009; Sabale *et al.*, 2008). Justicia adhatoda (Family: Acanthaceae) is a well-known plant used in Ayurvedic and Unani medicine (Claeson *et al.*, 2000). The plant has been recommended by physicians for the management of various types of respiratory disorders. The juice from the leaves and the decoction of the leaves and roots are helpful in diarrhoea, dysentery and glandular tumor (Ayyanar *et al.*, 2008). A wide range of phytochemical constituents such as vasicine, vasicinone etc have been isolated from J. adhatoda which possess activities like antitussive, abortifacient, antimicrobial, cardiovascular protection, anticholinesterase, anti-inflammatory and other important activities (Singh *et al.*, 2011). Beetroot (*Beta vulgaris* L.) belongs to the *Chenopodiaceae* family and is originally from temperate climate regions of Europe and North Africa. In Brazil, it is grown in the South and Southeast regions (77% of the total produce), and the annual yield is 30-40 tons per hectare, which corresponds to an average production of 280 tons. In street markets, indoor markets, and fruit and vegetable distribution centres, their leaves are cut off from the bulb to be used as organic fertilizer and animal feed or are discarded into the environment as waste (Amaral *et al.*, 2004; Mello **et al.,** 2008). Beetroot leaves are underused due to lack of proper knowledge, specially of their nutritive value and how to cook them and also because of dietary habits (Vilhena and Silva, 2007). *Brassica* vegetables such as cauliflower and broccoli are popular and are among the most consumed vegetables in the world. Among the antioxidants present in *in natura* vegetable leaves, phenolic compounds are found in great amounts, as well as in vegetables, fruit and medicinal plants (Abdel-Hameed, 2009). *Brassicas* are known to possess antioxidant activity (Deng *et al.*, 2012), (Podsedek *et al.*, 2007). Such beneficial health properties of these crops are due to the presence of health-promoting compounds such as vitamins, carotenoids, phenols, flavonoids, minerals, and glucosinolates (Aires *et al.*, 2011).

## METHODOLOGY

The selected leaves (Moringa and Adusa) are taken from the campus of SHAITS.

**Preparation of sample:**

Leaves were dried by hot air Oven drying method. Leaves were kept in an oven for drying at 60º C for 5 hrs and powder were made from dried leaves.

**Chemicals:**

All chemicals used for the chemical analysis were AR/GR grading.

**Estimation of Photochemical / Antioxidant activity:**

***Total phenol content (TPC):***

TPC was determined using the Folin- Ciocalteu's reagent (Singleton and Rossi, 1965). Samples (0.3 ml, triplicate) were introduced into test tubes followed by 1.5 ml of Folin-Ciocalteu's reagent (diluted 10 times with water) and 1.2 ml of sodium carbonate (7.5%w/v). The tubes were vortex, covered with par film and allowed to stand for 30 min. Absorption at 765 nm was measured. If the sample absorbance exceeded 1, the sample was appropriately diluted to give reading less than 1. Total phenol contents were expressed in Gallic acid equivalents (mg per 100 g fresh fruit). Since ascorbic acid also contributes to the formation of the blue molybdenum–tungsten complex, it is important to correct for the absorbance originating from it. An ascorbic acid calibration curve was therefore prepared.

**Determination of Radical Scavenging Activity:**

The free radical scavenging activity of the leaf extract extracts was measured by measuring the decrease in absorbance of methanolic DPPH solution at 517 nm in the presence of the extract. The initial concentration of DPPH was 0.1 mm and the reading was taken after allowing the solution to stand for 30 min.

In cases where the absorbance decreased too much (when the solution turned yellow) before the 30 min period, the sample was appropriately diluted.

% disappearance = (A control – A sample) /A control*100%

IC50, the amount of sample extracted into 1 ml solution necessary to decrease by 50% the initial DPPH concentration was derived from the % disappearance vs. concentration plot. (Concentration here means mg of fruit extracted into 1 ml solution.) The results are also expressed as ascorbic acid equivalent antioxidant capacity (AEAC) (Ranganna, 1986) using either one of the following equations where

AEAC mg AA/100gm = (A control – A sample) /A control- $AA_{AA}$

* Conc. AA mg/ml* vol. extract ml * 100 /g sample

**Ascorbic acid content (AAC):**

The AAC was determined by the iodine titration method (Ranganna, 1986) or the RP-HPLC method: Waters C-18 column (3.9-150 mm, 5 lm particle size), mobile phase 5% acetic acid, flow-rate 0.5 ml/min and 254 nm detection wavelength. Both methods gave similar results to within 5%.

**Total phenol content (TPC):**

TPC was determined using the Folin- Ciocalteu's reagent (Singleton and Rossi, 1965). Samples (0.3 ml, triplicate) were introduced into test tubes followed by 1.5 ml of Folin-Ciocalteu's reagent (diluted 10 times with water) and 1.2 ml of sodium carbonate (7.5%w/v). The tubes were vortex, covered with par film and allowed to stand for 30 min. Absorption at 765 nm was measured. If the sample absorbance exceeded 1, the sample was appropriately diluted to give reading less than 1. Total phenol contents were expressed in Gallic acid equivalents (mg per 100 g fresh fruit). Since ascorbic acid also contributes to the formation of the blue molybdenum–tungsten complex, it is important to correct for the absorbance

originating from it. An ascorbic acid calibration curve was therefore prepared.

## RESULTS AND DISCUSSION

DPPH radical scavenging ability higher than that of a reference compound ascorbic acid (vitamin C). The most active DPPH radical scavenger, TOT4951 exhibited a scavenging ability five times more than that of ascorbic acid. The least active DPPH radical scavenger CHM, had twice the scavenging ability compared to ascorbic acid. This suggests that all the cultivar extracts tested in this study serves as better antioxidants than ascorbic acid (Ashwell *et al.,* 2014)

**Table 1 : Antioxidant activity parameter Moringa (*Moringa Oleifera)* leaves**

| Parameter / Sample | Moringa (*Moringa oleifera)* (R1) | Moringa (*Moringa oleifera)* (R2) | Mean |
|---|---|---|---|
| DPPH | 68.321 | 67.524 | 67.921 |
| Ascorbic acid | 48 | 48.5 | 48.25 |

A significant relationship between antioxidant potential and total phenolic content was found, indicating that phenolic compounds might be the major contributors to the antioxidant potential (Arvinder *et al.,* 2015).

**Table 2 : Antioxidant activity Adusa (*Justicia adhatoda)* leaves**

| Parameter / Sample | Adusa (*Justicia adhatoda)* (R1) | Adusa (*Justicia adhatoda)* (R2) | Mean |
|---|---|---|---|
| TPC | 25.23 | 26.01 | 25.62 |
| Ascorbic acid | 2.928 | 2.425 | 2.677 |

Cauliflower leaves are a good source of those phytochemicals. Similarly, the highest levels of vitamin C, total phenol, total flavonoids, free sugar, and antioxidant activity were observed in the cauliflower cultivars, whereas the highest total glucosinolates was present in the broccoli cultivars; however, no specific cultivar had significantly higher quantities of all the phytochemicals (Shiva Ram Bhandari and Jung-Ho Kwak, 2015).

**Table 3 : Antioxidant activity cauliflower (*Brassica oleracea)* leaves**

| Parameter / Sample | Cauliflower leaf (R1) | Cauliflower leaf (R2) | Mean |
|---|---|---|---|
| DPPH | 0.6012 | 0.8820 | 0.742 |
| Ascorbic acid (mg/100g) | 0.6781 | 0.6794 | 0.679 |
| TPC | 1.542 | 1.541 | 1.541 |

The total phenolic contents in dried beetroot leaves (DBL) was higher than those found in *in natura* beetroot leaves . In other studies on food matrices the relationship between phenolic compounds and antioxidant activity has been observed, as reported by (Michiels *et al.,* 2012).

**Table 4 : Antioxidant activity Beetroot (*Beta vulgaris* L.) leaves**

| Parameter / Sample | Beet root leaf (R1) | Beet root leaf (R2) | Mean |
|---|---|---|---|
| DPPH | 0.127 | 0.523 | 0.325 |
| TPC | 0.285 | 0.265 | 0.275 |

## Conclusion :

Above study showed that the beetroot leaves are having significant antioxidant activity and amounts of total phenolic compounds, powder obtained from beet root possess considerable amounts of phenolic compounds and a significant radical scavenging activity towards stable DPPH, antioxidant activity were observed in the cauliflower. So we can said that in natural and dehydrated beetroot leaves can be used in the preparation of broths, meals and/or added to other foods, and that the dehydrated leaves have the antioxidant value. *Moringa oleifera* leaves bear a potent antioxidant activity. The antioxidant potential may be attributed to the presence of polyphenolic compounds and might be equally beneficial to human antioxidant protection system against oxidative damage. These results are encouraging enough to pursue characterization of these fractions. The fractions obtained from *J. adhatoda* acquire excellent antioxidant activities. It was seen that fractions are strong and effective enough as a scavenger of free radical, superoxide radical and hydrogen peroxide radicals. The observed bioactive activity may be due to group of phenolic compounds present in different fractions.

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