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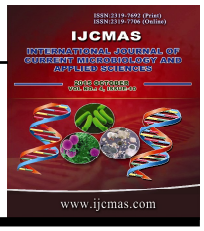

Original Research Article

In vitro Antioxidant Properties of *Moringa oleifera* and *Tagetes erecta* Flower Extracts

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Keywords

Edible flowers, Antioxidant, Total Antioxidant Activity, Total Phenolic content, *Moringa oleifera*, *Tagetes erecta*

A B S T R A C T

Edible flowers, which have been used in the culinary arts for centuries, are experiencing renewed popularity. Flowers can serve as an essential ingredient in a recipe, provide seasoning to dish, or simply be used as a garnish. The characteristic of dried edible flowers includes novelty, longevity, aesthetics, flexibility and year round availability. The main objectives of the study were to investigate the Total Antioxidant Activity, Total Phenolic content ,Total Flavanoid Content, of *Moringa oleifera* and *Tagetes erecta* flower extracts. The present study indicates that Edible flowers were rich sources of Phytochemicals with higher levels of Phenolic compound and antioxidant activities by inhibiting DPPH and Hydrogen peroxide radicals. This study proven that *Moringa oleifera* and *Tagetes erecta* can be used as food supplement.

Introduction

At the present point in time the modern conventional healthcare is hampered with great problems of unsafe medicines, chronic diseases, resistant infections, autoimmune disorders and degenerative disorders of ageing, even though great scientific advances. More than 70 % of India's 1.1 billion populations still use these non-allopathic systems of medicines (Paul *et al.*,2006). Medicinal plants and derived medicines are widely used in traditional cultures all over the world and they are becoming increasingly popular in modern society as natural alternatives to synthetic chemicals (Vanwyk *et al.*,2009).In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects (Patel *et al.*, 2001).The World Health Organization (WHO) estimated that approximately 80 % of world population relies mainly on traditional medicines, mostly plant drugs in their health care (Priyanka *et al* ., 2013).

Flowers have been used for edible purpose since ancient times, and have medicinal as well as nutritional value. Now a day, in the Western world, the most common use of flowers is in salads. But more and more people are becoming adventurous as they realize the flavor and health potential of flower blossoms and bud (Sharma *et al.*2011*).* Edible flower is just what the name implies, a flower or part of flower that can be eaten. Although edible flowers are most popular in fresh salads and imaginative uses for the colored petals are being explored that open beautiful and tasty culinary vistas (Mlcek,2011). Edible flowers becoming more popular as evidenced by an increase in the number of edible flower cook books, culinary magazine articles, and television shows. Consumer purchase packaged edible flowers for use in meals as a garnish or ingredients in salads, soups, desserts and drinks (Pegoraro, 2007).

Moringa oleifera is the most widely cultivated species of a monogeneric family, the Moringaceae, that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. This rapidly-growingtree (also known as the horse radish tree, drumstick tree, benzolive tree, kelor, marango, mlonge, moonga, mulangay, nébéday, saijhan, sajna or Ben oil tree),was utilized by the ancient Romans, Greeks and Egyptians;it is now widely cultivated and has become naturalized in many locations in thetropics (Fahey,2005).Described as "one of the most amazing trees God has created", almost every part of drumstick viz. bark, root, fruit, flowers, leaves, seed and gum is a rich repository of proteins, vitamins and minerals including potassium, calcium, phosphorus, iron, folic acid as well as β carotene. Leaves can be eaten fresh, cooked or stored as dry powder for many months without refrigeration, without loss of nutritional value. Almost all the parts of this plant have been used for various ailments in the indigenous medicine of South Asia (Price, 1985 ; Parrotta,2001).Almost all the parts of this plant: root, bark, gum, leaf, fruit [pods], flowers,seed and seed oil have been used for various ailments in the indigenous medicine of South Asia, including the treatment of inflammation and infectious diseases along with cardiovascular, gastrointestinal ,hematological and hepato-renal disorders (Kumar *et al.*,2010).

The flowers can be eaten or used to make a tea. In Haiti, tea from the flowers is drunk for colds. The flowers provide good amounts of calcium and potassium. Moringa flowers also provide a year-round source of nectar for bees, although some have claimed that honeybees do not gather nectar from Moringa (Price M, 2007).Different parts of this plant including flower are used in folk medicine to cure various diseases. Leaves are used as antiseptic and in kidney troubles, muscular pain, piles and applied to boils and carbuncles. The flower is useful in fevers, epileptic fits (Ayurveda), astringent, carminative, stomachic, scabies and liver complaints and is also employed in diseases of the eyes (Nikkon *et al.*,2009).

So with this view the present study on "*In vitro* Antioxidant properties of *Moringa oleifera* and *Tagetes erecta* flower extracts " was carried out with the following objectives includes to investigate the Total Antioxidant Activity of *Moringa oleifera* and *Tagetes erecta* flower extracts. To investigate the Total Phenolic content of *Moringa oleifera* and *Tagetes erecta* flower extracts. And also to investigate the Total Flavanoid Content of *Moringa oleifera* and *Tagetes erecta* flower extracts.

Materials and Methods

Selection of edible flowers

Fresh flowers of *Moringa oleifera* &

Tagetes erecta were procured from various parts of Kasargod District, Kerala, India in the month of January.

Processing of edible flowers

Procured flowers were washed thoroughly with water to remove earthy matters and made them free from debris. Cleaned flowers were shade dried at room temperature for 10 to 15 days and dried materials were pulverized in mechanical grinder to powder form.

Extraction of bioactive compounds from edible flowers

Plants and herbal extracts have formed important position in modern medicine, due to their chemical and medicinal contents found in natural from. Their secondary metabolites represent a large reservoir of structural moieties which work together exhibiting a wide range of biological activities (Devanaboyina *et al.*, 2013)

Procedure used for the extraction of bioactive compounds from edible flowers is is as follows.

Preparaton of extract

For Aqueous extraction, 2.5g of each powdered plants was added to 50ml of distilled water and boiled seperately.

↓

It is then filtered with a filter paper and allowed to cool.

↓

For solvent extraction, same was repeated with Ethanol & Chloroform.

↓

1.5 g of the plant powders were dissolved in both solvents separately and filtered.

↓

An aromatic filtrate was obtained and later plugged with cotton.

Determination of total antioxidant activity of edible flowers

Antioxidant compounds like phenolic acid, polyphenol and flavonoid has ability to scavenge free radicals thus inhibit the oxidative mechanisms that lead to degenerative diseases (Heim *et al.*,2000 ; Islam S.,2006)

The scavenging activity of DPPH free radicals and Hydrogen peroxide radical scavenging activity by different plant extracts were determined according to the method reported by Gyamfi(2007).The procedure used for the determination of total antioxidant capacity of edible flowers.Scavenging activity of DPPH free radicls by different plant extracts was determined according to the method reported by Gyamfi (2007). Fifty microliters of the plant extract in methanol, yielding 100 μg/ml in each reaction, was mixed with 1ml of 0.1mM DPPH in methanol solution and 450 μl and 50 mM Tris-HCL buffer (pH 7.4). methanol (50 μl) only was used as experimental control. After 30 min of incubation at room temperature, the reduction in the number of DPPH free radicals was measured, reading the absorbance at 517nm. BHT and α-tocopherol were used as control.

Inhibition Value = {(Ab-Aa]/Ab}*100

Where Ab is the absorption of the blank sample and Aa is the absorption of the extract.

Determination of total phenolic content of edible flowers

Studies have indicated that these phytochemicals, especially polyphenols, have high free-radical scavenging activity, which helps to reduce the risk of chronic

diseases, such as cardiovascular disease, cancer, and age related neuronal degeneration (Ames *et al.,* 2003).

Total soluble Phenolic content of edible flower extract were determined by using the Folin Ciocalteu assay, following the method of Kim et al (2007). The procedure used for the determination of total phenolic content of edible flowers. Total soluble phenolic content were determined by using the Folin-Ciocalteu assay, in total 100 µl of each extract (1 mg/ml) was added to a test tube containing 50µl of the phenol reagent (1m). A further 1.85 ml of distilled water was added to the solution and allowed to stand for 3 min after vortexing, then 300 µl Na_2CO_3 (20 % in water, v/v) was added and vortexes, and the final volume (4ml) was obtained by adding 1.7ml of distilled water. A reagent blank was prepared by using distilled water. The final mixture was vertexes , and then incubated for 1 hr in the dark at room temperature. The absorbance was measured at 765 nm using UV-VIS Spectrophotometer. A standard curve was prepared using 100 µg, 200µg, 300µg, 400µg, 500µg Gallic acid in methanol; water (50:50 v/v). total phenolic value are expressed in terms of Gallic acid equivalents (GAE) in milligrams per gram plant extract. All determination were performed in triplicate.

Determination of total flavonoid content of edible flowers

Total flavonoid content of edible flower extract were determined by means of calorimetric method of Quettier et al.,(2000). The procedure used for the determination of total flavonoid content of edible flowers. Total flavanoid content was determined by means of a colorimetric methods. Briefly 250 µml of diluted extract were mixed with 75 µl of a 5 % $NaNO_2$ solution. 150µl of a freshly prepared 10 % $A1C1_3$ solution, and 500 µl of 1M NaOH. The final volume was adjusted to 2.5 ml with distilled water. The mixture was allowed to rest for 5 min, after which absorption was measured at λ= 510 nm. A mixed solution having no extract or standard was employed as a blank. The amount of total flavanoids was expressed as mg quercetin equivalents (CE)/ g sample.

Results and Discussions

Determination of total antioxidant activity of edible flowers

The Antioxidant activities of Edible flowers were determined by DPPH Assay and Hydrogen peroxide radical scavenging activity methods. DPPH Assay is a preliminary test to investigate the antioxidant potential of extracts. This assay has been widely used to test the free radical scavenging ability of various samples. The Total Antioxidant Activity of Edible flower extracts is presented in Table I.

In present investigation, the antioxidant activity properties of the Marigold and Moringa flowers were estimated by water and methanol extracts. From the Table I, It can be observed that in *Moringa oleifera* , the DPPH activity was high in water extract followed by Methanol extract (77.81 and 46.33 %). In *Tagetes erecta*, water extract contained maximum DPPH activity followed by methanol extract (58.269 and 24.675 %).

In the case of Hydrogen peroxide radical scavenging activity, Water extracts showed the maximum Antioxidant content. In general, methanolic extracts of *Moringa oleifera* and *Tagetes erecta* extracts shown lesser Antioxidant activity as compared to Water extracts.

Table.1 Total antioxidant activity of edible flowers

Sl No.	Name of the flower	Extract	DPPH Activity (%)	Hydrogen peroxide Radical Scavenging Activity (%)
1.	***Moringa oleifera***	**Water**	**77.813**	**88.925**
		Methanol	**46.334**	**64.446**
2.	***Tagetes erecta***	**Water**	**58.269**	**66.285**
		Methanol	**24.675**	**43.835**

Table.2 Phenolic content of edible flowers

Sl No.	Name of the flower	Total Phenolic Content (mg/ml)
1.	***Moringa oleifera***	**24**
2.	***Tagetes erecta***	**20**

Table.3 Flavanoid content of edible flowers

Sl No.	Name of the flower	Total Flavanoid Content (mg/µl)
1.	***Moringa oleifera***	**0.48**
2.	***Tagetes erecta***	**1.92**

Figure.1 Total antioxidant activity of edible flower water extracts

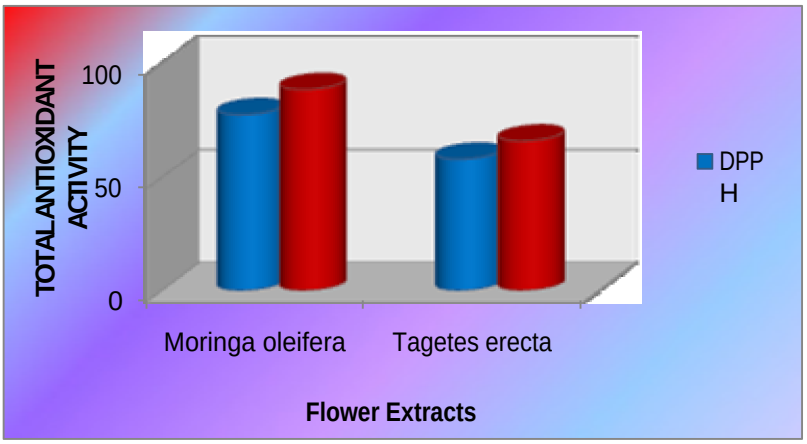


Figure.2 Total antioxidant activity of edible flower methanol extracts

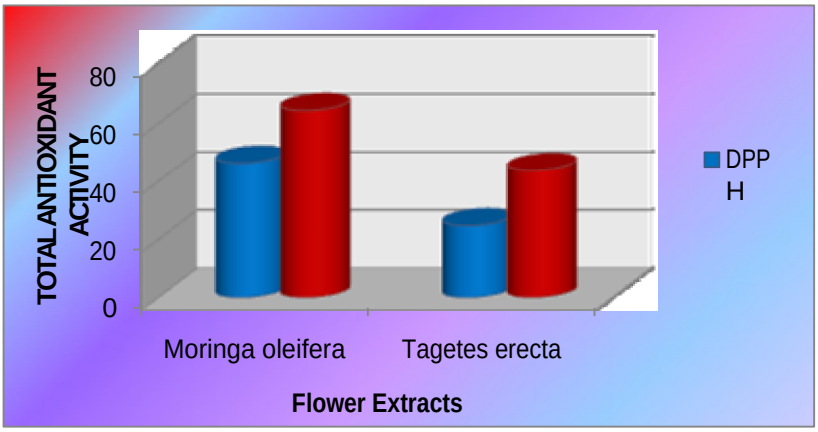


Figure.3 Phenolic content of edible flowers

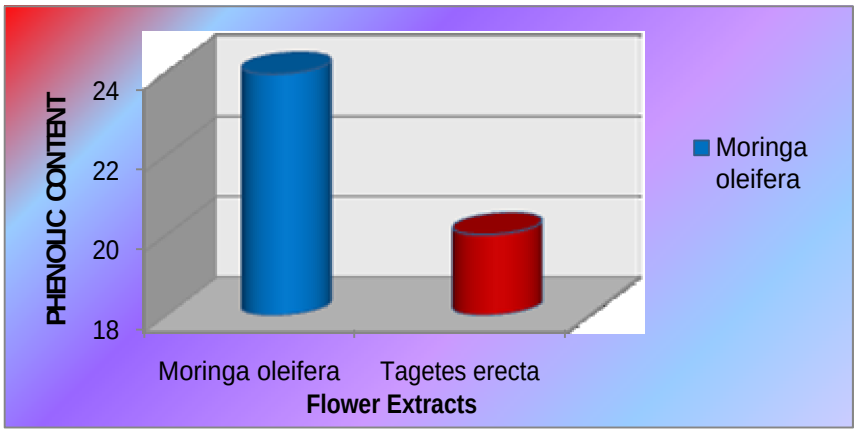
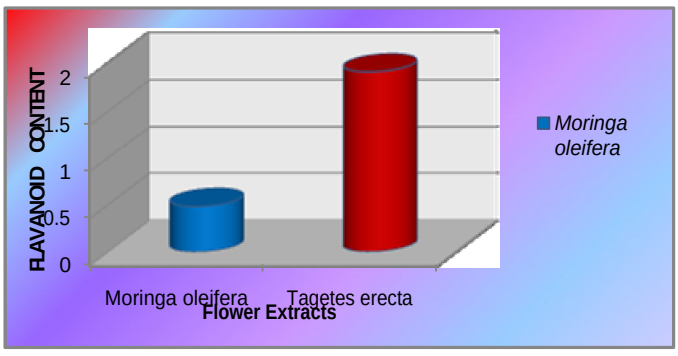


Figure.4 Flavanoid content of edible flowers



In DPPH Assay and Hydrogen peroxide radical scavenging activity methods, Extracts of *Moringa oleifera* shown higher antioxidant activities as compared to *Tagetes erecta*.

The Total Antioxidant Activity of Water and Methanolic extracts of Edible flowers by using the DPPH Assay and Hydrogen peroxide Radical Scavenging Activity methods are graphically represented in FIGURE I and FIGURE II.

Determination of total phenolic content of edible flowers

Total soluble phenolic content of edible flower extract were determined by using the Folin Ciocalteu assay, following the method of Kim et al.,(2007). The Total Phenolic Content of Edible flowers are presented in Table II. It was clear that, the total phenolic content of edible flowers were in the order *Moringa oleifera* > *Tagetes erecta*. *Moringa oleifera* (40mg) has higher amount of Phenolic content than *Tagetes erecta.* (40mg).The Total Phenolic Content of Edible flowers is graphically represented in FIGURE III.

Determination of total flavanoid content of edible flowers

Total Flavanoid content of edible flower extracts were determined by means of calorimetric method of Quettier et al., (2000).The Total Flavanoid Content of Edible flowers is presented in TABLE III.
It was clear that, The total flavanoid content of edible flowers were in the order *Tagetes erecta* > *Moringa oleifera*. *Tagetes erecta* (1.92mg) has higher amount of flavanoid content than *Moringa oleifera.* (0.48mg).The Total Flavanoid Content of Edible flowers is represented graphically in Figure IV.

In conclusion, The data of two edible flower samples, *Moringa oleifera* and *Tagetes erecta* in the present study indicates that Edible flowers were rich sources of Phytochemicals with higher levels of Phenolic compound and antioxidant activities. Furthermore, observations of two edible flowers such as, *Moringa oleifera* and *Tagetes erecta* which were investigated in this study, the extract of *Moringa oleifera* showed higher antioxidant activities by inhibiting DPPH and Hydrogen peroxide radicals, Total Phenolic content than *Tagetes erecta* where as *Tagetes erecta* showed higher flavanoid content than *Moringa oleifera*.

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