

# A Review on Antioxidant Activity of *Rosa Damascena*

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## ABSTRACT

*Rosa damascena* is one of the most important *Rosa* species for the flavour and fragrance activities. Roses are well known as ornamental plants grown for their flowers in garden and indoors. This plant is cultivated all over the world including Iran, Europe, Bulgaria, Turkey and India. Various parts of *Rosa damascena* like petals, hips, stems, leaves and roots having medicinal properties and contains various secondary metabolites including vitamins and minerals. The flower petals of *Rosa damascena* are high in phytonutrients with antioxidant and antibacterial properties. This plant has been used in Ayurveda and Unani systems of medicine since ancient era and have many pharmacological properties including anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, antifungal, antiaging, anti-inflammatory and others. Various products can be obtained from *Rosa damascena* are rose water, rose oil and medicinal products.

**Keywords:** *Rosa damascena*, Damask rose, Antioxidant activity, Rose oil, Rose water

## INTRODUCTION

Antioxidants are compounds that inhibit oxidation (usually occurring as autoxidation), a chemical reaction that can produce free radicals. Antioxidants can attenuate the damaging effects of ROS in

vitro and delay many events that contribute to cellular aging.<sup>[1]</sup>

Antioxidant refers to a compound that can delay or inhibit the oxidation of lipids or other molecules by inhibiting the initiation or propagation of oxidative chain reactions and which can thus prevent or repair damage done on the body's cell's oxygen. They act by one or more of the following mechanisms: reducing activity, free radical scavenging potential complexing of pro-oxidant metals, and quenching of singlet oxygen. Epidemiological studies have shown that many phytonutrients of fruits and vegetables might protect the human body against damage by ROS. The consumption of natural antioxidant phytochemicals was reported to have potential health benefits. The antioxidant phytochemicals from plants, particularly essential oil components, flavonoids, and other polyphenols, have been reported to inhibit the propagation of free radical reactions, to protect the human body from disease and to retard lipid oxidative rancidity.<sup>[2]</sup>

*Rosa damascena* Mill. is one of the most important *Rosa* species for the flavour and fragrance industries. The high number of residues of spent flowers after steam distillation and the potential use of their essential oils as natural antioxidants and antimicrobials lead to determining the antioxidant and antibacterial activities of fresh *Rosa damascena* flower extracts.<sup>[3]</sup>

This plant is cultivated all over the world including Iran, Europe, Bulgaria, Turkey and India. Turkey is the most important country growing *Rosa damascena* in the world. Approximately 10,000 tonnes of rose flowers are grown annually for essential oil production in Turkey.

It has been used in Ayurveda and Unani systems of medicine since the ancient era. Various species of Rose have been utilised for several important pharmacological properties such as astringent, mild laxative, antibacterial, anti-fungal, anti-HIV, antidiabetic, anti-depressant, analgesic, hypnotic, anti-hepatitis, anticancer, anti-aging, antioxidant, antitussive, anti-inflammatory, neuroprotective, respiratory effects, etc. [4]

Pharmacological and phytochemical studies have revealed that the various health benefits of rose plant can mainly because of the presence of polyphenolic compounds, essential oils, flavonoids, glycosides, terpenes, and anthocyanins. [5]

This plant is cultivated in Iran for preparing rose water and essential oil. Because of low oil content in *Rosa damascena* and lack of synthetic substitutes, essential rose oil of this plant is one of the most expensive ones in the world market. The *Rosa damascena* has also been used for medicinal purposes. Various products and isolated constituents from flowers, petals, and hips of this plant have been studied in a variety of *in vivo* and *in vitro* studies.

The different products from *Rosa damascena* are rose water, rose oil, dried flower etc. Rose oil heals depression, grief, nervous stress and tension. It helps in the reduction of thirst, healing old cough, wound healing and skin health. [6]

*Rosa damascena* is commonly known as damask rose belonging to the family Rosaceae.

*Rosa damascena* is a perennial bushy shrub reaching approximately 1 to 2 meters in height with large, showy and colourful flowers. The leaves are imparipinnate and compound with 5-7 leaflets.

Its life span is up to 50 and economic period is about 25 years. Gestation period is three years for attaining economic production level. Its propagation is mostly by cutting and using Suckers but micropropagation is a developing propagation method for this plant. [7]

### **Phytochemistry of *Rosa damascena*:**

#### **Chemical composition:**

Several components were isolated from flowers, petals and hips (seed-pot) of *R. damascena* including terpenes, glycosides, flavonoids, antioxidants and anthocyanins. This plant contains carboxylic acid, myrcene, vitamin C, kaempferol and quercetin. Flowers also contain a bitter principle, tanning matter, fatty oil and organic acids. [8]

The major chemical constituents present in the oil of *Rosa damascena* are  $\beta$ -citronellol (31.15%), trans-geraniol (21.24%), n-heneicosane (9.05%), n-nonadecane (8.77%), nonadecene (4.55%), phenylethyl alcohol (4.16%), eugenol (0.7%), methyl eugenol (0.05%) etc.

The antioxidants are mainly present in the flowers of *Rosa damascene*. [9]

#### **Rose water as cosmetics:**

It is an abundant product of *Rosa damascena* in which contains 10-50% rose oil. The most usage of Rose water is in religious ceremonies. It is used in mosques especially at mourning ceremonies, to calm and relax people. The highest quality rose water is produced in Kashan. Kaaba (God House) in, is washed yearly by unique and special rose water of Kashan. Rose water is also of high value in the food industry and some special foods are prepared using this product. [10]

#### **Rose oil:**

It is a volatile oil obtained by distillation of the fresh flowers of *Rosa damascena*. The chief producing countries are, and but not a major product in. The oil is prepared in copper alembic stills by the peasant or in large factories under careful scientific

control. Some 3000 parts of flowers yields only one part of oil. The oil is very expensive and very liable to adulteration. The oil is, pale, yellow, and semisolid. The portion which is solid at ordinary temperatures forms about 15-20% and consists of odourless stearoptene containing principally saturated aliphatic hydrocarbons (C14-C23 normal paraffins). Because of the low oil content in *R. damascena* and the lack of natural and synthetic substitutes, essential rose oil is one of the most expensive ones in the world markets. [11]

#### **Dried flowers:**

Two kinds of dried flowers are produced in dried bud which is mostly for export, dried petals for different purposes; its major use is for eating, as it can solve problems with digestive system. Some Iranians eat it with yogurt. Another reason for drying petals is to store them when distilleries cannot accept the whole produced flower anymore. They use them later for distillation. [12]

#### **Hips:**

Both dried and fresh hips of *Rosa damascena* processed or not processed, are used in Iran. [13]

#### **Materials and methods for the determination of antioxidant activity:**

##### **Materials:**

The fresh rose flowers of *Rosa damascena* has to be collected and the fresh flowers has to be dried in room temperature conditions and their extracts are produced by suitable methods. [14]

#### **METHODS:**

##### **Preparation of the Plant Extract:**

Take about 15 g of dried flower materials were extracted with 150 mL methanol for 1 min using an Ultra Turax mixer (13,000 rpm) and soaked overnight at room temperature. The sample was then filtered through Whatman No.1 paper in a Buchner funnel. The filtered solution was evaporated under vacuum in a rotavator at T40 °C to a constant weight and then dissolved in

methanol. The dissolving rate of the crude extracts was approximately 100%. The solution was stored at 18°C until use. [15]

##### **Determination of Total Phenol content:**

The amount of phenolic compounds in the flower extracts of *Rosa damascena* is determined by the Folin-Ciocalteu colorimetric method. The total phenolic contents were expressed as mg gallic acid equivalents (GAE)/g extract. [16]

##### **Determination of Antiradical Activity:**

A 1.0 mL methanolic solution of the extract and butylated hydroxytoluene (BHT) at 100 ppm (methanol for the control) was placed in a test tube and 2.0 mL of a  $\alpha$ -diphenyl- $\beta$ -picrylhydrazyl (DPPH) methanolic solution (10 ppm) was added. The absorbance was measured at 517 nm after 5 min of reaction. The percentage of DPPH decolouration of the samples was calculated according to the following equation: [17]

Antiradical activity =  $100 \cdot (1 - \text{absorbance of sample} / \text{absorbance of control})$

##### **Evaluation of Antioxidant Activity:**

The antioxidant activities of extracts were evaluated by the formation of phosphomolybdenum complex method. An aliquot of 0.4 mL of sample solution (100 ppm in methanol) was mixed in a vial with 4 mL of reagent solution (0.6 M sulphuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). The blank was prepared by replacing the sample with 0.4 mL of the methanol sample. The vials were capped and incubated in a water bath at 95 °C for 90 min. After cooling the samples at room temperature, the absorbance of the mixture was measured at 695 nm against the blank. The antioxidant activity was expressed relative to that of ascorbic acid. [18]

##### **Antioxidant effects:**

The *Rosa damascena* similar to many aromatic and medicinal plants exhibits antioxidant properties. Sources of natural antioxidant are primarily phenolics

compound that are found in all parts of plants such as the fruits, vegetables, seeds, leaves, roots and barks. The presence of phenolic compound in ethanolic extract of *Rosa damascena* has been shown in many articles. They determined antioxidant activity of this extract compare to standard antioxidant L-ascorbic acid by 1,1-diphenyl-2-picryl hydroxyl (DPPH) free-radical method. This study showed that *Rosa damascena* has high antioxidant activities. The antioxidant activity of hydro-alcoholic extract of petals and essential oil of this plant was also evaluated by DPPH for measurement of free radical scavenging activity and by ferric ammonium thiocyanate method for evaluation of lipid peroxidation properties. Additionally, three flavonol glycosides of ethanolic extract including quercetin-3-O-glucoside, kaempferol-3-O-rhamnoside and kaempferol-3-O-arabinoside have antioxidant activity. However, the potential of this effect is maybe due to existence of quercetin 3-O-glucoside and other flavonoids in the extract. Both fresh flower (FF) and spent flower (SF) extracts of *Rosa damascena* flowers also showed antioxidant activity. However, the antioxidant activity of FF extract was higher than that of SF extract. The antioxidant effect of *Rosa damascena* and its inhibitory effect on lipid oxidation were evaluated in an *in vivo* study. The results showed a potent antioxidant and lipid peroxidation inhibitory effects comparable to tocopherol and suggest that the plant can be considered as a medical source for the treatment and prevention of many free radical diseases. [19]

#### **Pharmacological uses of *Rosa damascena*:**

The most therapeutic effects of *Rosa damascena* in ancient medicine are including treatment of abdominal and chest pain, strengthening the heart, treatment of menstrual bleeding and digestive problems, and reduction of inflammation, especially of the neck. North American Indian tribes used a decoction of the root of *R. damascena* plant as a cough remedy to ease children's

cough. This plant is also used as a gentle laxative. Rose oil heals depression, grief, nervous stress and tension. It helps in the reduction of thirst, healing old cough, special complaints of women, wound healing, and skin health. Vapor therapy of rose oil is helpful for some allergies, headaches, and migraine.

It has been shown that *Rosa damascena* has wide spectrum of anti-microbial activities. [20]

#### **Other Pharmacological effects:**

##### **Hypnotic effect:**

One of the effects of *Rosa damascena* on central nervous system is its hypnotic effect. The ethanolic, aqueous and chloroformic extracts from *R. damascena* were used for hypnotic effect in mice. The ethanolic and aqueous extracts in doses of 500 and 1000 mg/kg significantly increased the pentobarbital induced sleeping time in mice which was comparable to diazepam. However, the chloroformic extract has not shown to have hypnotic effect. [21]

##### **Analgesic effect:**

The analgesic effect of *Rosa damascena* is also reported. In a study, the effect of aqueous, ethanolic and chloroformic extracts in mice on hot plate and tail flick was evaluated and only ethanolic extract showed analgesic effect. The analgesic activity of hydroalcoholic extract and essential oil of *Rosa damascena* in acetic acid formalin and tail flick tests in mice demonstrated that essential oil of the plant failed to show any analgesic effect. However, hydroalcoholic extract has a potent analgesic effect in acetic acid and formalin tests and no effect on tail flick test. [22]

##### **Anticonvulsant effect:**

The essential oil of *Rosa damascena* in acute pentylenetetrazole (PTZ)-induced seizure in rats, delays the start of epileptic seizures and decrease the duration of tonic-clonic seizures (stage 4). In chronic model of PTZ-induced seizure, this plant also

caused prolongation of latent periods before tonic-clonic generalized seizures. Injection of essential oil 30 min before amygdala electrical kindling also reduced appearance of 1st, 2nd, 3rd, 4th, and 5th stages of seizure and could reduce the time after discharge duration. It is suggested that essential oil of *Rosa damascena* retarded the development of behavioural seizures in amygdala electrical kindling and possesses the ability to counteract kindling acquisition. [23]

#### **Effect on cardiovascular system:**

The research on the cardiovascular effect of *Rosa damascena* is little. In one study aqueous-ethanolic extract from *Rosa damascena* potentially increased heart rate and contractility in isolated guinea pig heart. The mechanisms of these effects are unknown. However, a possible stimulatory effect of the plant on  $\beta$ -adrenoceptor of isolated guinea pig heart is suggested. [24]

#### **Anti-diabetic effect:**

It has been found that *Rosa damascena* exert an anti-diabetic effect. Oral administration of the methanol extract of this plant significantly decreased blood glucose after maltose loading in normal and diabetic rats in a dose-dependent manner. In addition, its methanol extract inhibited postprandial hyperglycemia similar to acarbose. It was found that *Rosa damascena* is a potent inhibitor of  $\alpha$ -glucosidase enzyme. Therefore, anti-diabetic effect of this plant may be mediated by inhibition of  $\alpha$ -glucosidase that suppressed carbohydrate absorption from the small intestine and can reduce the postprandial glucose level. [25]

#### **Antimicrobial effect:**

It has been shown that *Rosa damascena* has wide spectrum antimicrobial activities. Essential oil and hydrosol are important products that showed these effects. It has been shown that essential oil has strong antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis*. [26]

#### **The anti-inflammatory effect:**

This plant has also been shown to have anti-inflammatory effect. The effect of essential oil and hydroalcoholic extract of *Rosa damascena* on rat paw edema induced by carrageenan was demonstrated. Essential oil had no anti-inflammatory effect while the extract could significantly reduce edema which may be acted by inhibiting the mediators of acute inflammation. In addition, *Rosa damascena* contains vitamin C which has antioxidant and anti-inflammatory effects. [27]

#### **Anti-aging effect:**

The effects of a rose-flower extract on the mortality rate of *Drosophila melanogaster* were evaluated in a recent study. Supplementing *Drosophila* with the plant extract resulted in a statistically significant decrease in mortality rate in male and female flies. Moreover, the observed anti-aging effects were not associated with common confounds of anti-aging properties, such as a decrease in fecundity or metabolic rate. Therefore, *Rosa damascena* can extend *Drosophila* life span without affecting physiological mechanisms. This study postulated that the plant's antioxidant properties could have contributed to prolongation of life span in *Drosophila*. [28]

## **CONCLUSION**

*Rosa damascena* is normally known to everyone as an ornamental plant and for its fragrance activities. The flower extracts of *Rosa damascena* is prepared and evaluation of antioxidant activity is done. Rose extracts are used as a source of natural antioxidants for healthy products including oxidative and subsequent disease progression. *Rosa damascena* has several pharmacological properties such as antioxidant, antibacterial, antifungal, anti-inflammatory, anti-aging and others. The various products of *Rosa damascena* are rose water rose essential oil and medicinal products.

#### **Declaration by Authors**

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