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## Review Article

# Therapeutics and pharmacology of *Gul-e-Surkh* (*Rosa damascena* Mill): An important Unani drug

Shaiqua Ansari<sup>1</sup>, Fahmeeda Zeenat<sup>2\*</sup>, Wasim Ahmad<sup>3</sup>, Intezar Ahmad<sup>4</sup>.

<sup>1</sup>Department of Qabalat wa Amraz-e-Niswan, Mohammadia Tibbia College, Malegaon, Nashik, M.S., INDIA.

<sup>2</sup>Department of Amraze Niswan wa Atfal, Faculty of Unani Medicine, AMU, Aligarh, U.P., INDIA.

<sup>3</sup>Department of Ilmul Advia, Mohammadia Tibbia College, Malegaon, Nashik, M.S., INDIA.

<sup>4</sup>Hakim Syed Ziaul Hasan Govt. Unani Medical College, Bhopal. M.S., INDIA.

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## ABSTRACT

*Gul-e-Surkh* (rose) is the flower of the plant *Rosa damascena* Mill that is one of the most important aromatic and medicinal plants traditionally used for various health needs. It is an erect shrub, up to 2 m in height. This plant is cultivated throughout the world because of its beauty and fragrance. It is the most famous than any other flower throughout the world. It has been referred to as the king of flowers. At present time, over 200 rose species and more than 18000 cultivars form of the plant has been identified, among them *Rosa damascena* is one of the most important species of Rosaceae family. Apart from its use as ornamental plants in parks, gardens, and houses, they are principally cultivated for use in perfume, medicine, and food industry. Rose oil or otto or attar of roses is freely used as perfumes by rich classes. Otto is seldom used medicinally except for perfuming emollients and medicinal soap. The plant has shown diverse biological and pharmacological activities. It has been used in Unani Medicine (Tibb-e-Unani) since ancient era. Keeping in view the high medicinal importance of the plant in Unani Medicine, this review provides available information on its therapeutic uses, phytochemistry and pharmacological properties.

\*AUTHOR FOR CORRESPONDENCE

E-mail address: [fahmeedazeenat@gmail.com](mailto:fahmeedazeenat@gmail.com)

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## INTRODUCTION

Rose (*Rosa damascena*) is the most famous than any other flower throughout the world. It belongs to the family Rosaceae. Its actual place is India but because of its beauty and fragrance, it is cultivated throughout the world (Ansari, 2009). There is evidence that Rosaceae family is an ancient plant. Some fossils of rose are found in America that is 30 million years old. At present time, over 200 rose species and more than 18000 cultivars form of the plant has been identified, among them *Rosa damascena* Mill is one of the most important species of Rosaceae family (Boskabady et al., 2011). Abu Hanifa classified the rose into two types according to geographical condition, one is from hills and another is from the desert. Ishaque bin Imran classified it

according to color as red and white. According to Dolees bin Tameem, black color roses are also found. But the one which is more reddish in color with strong fragrance is used (Ibn Baitar, 2003). It is a well-known ornamental plant and has been referred to as the king of flowers. Its origin is the Middle East. There are also many pieces of evidence that cultivation and consumption of *Rosa damascena* in Iran has a long history and Iran is one of its origins (Boskabady et al., 2011). Apart from its use as ornamental plants in parks, gardens, and houses, they are principally cultivated for use in perfume, medicine, and food industry. There is a strong bond between this plant and Iranians. Its popularity is not only because of the medicinal effects

but also is due to holy beliefs about it. People call this plant flower as Gule Mohammadi i.e. flower of Prophet Mohammed (SAW) because they believe it is nice aroma reminds them of Prophet Mohammad (SAW). Because of the low oil content in *Rosa damascena* and the lack of natural and synthetic substitutes, essential rose oil of this plant is one of the most expensive ones in the world markets (Boskabady et al., 2011). Rose oil or otto or attar of roses is freely used as perfumes by rich classes. Otto is seldom used medicinally except for perfuming emollients and medicinal soap (Nadkarni, 1954). Iran was the main producer of rose oil until the 16th century and exported it to all around the world (Boskabady et al., 2011). Petals of lakh of rose flowers are employed for the production of the average yield of good attar (otto or oil) (Nadkarni, 1954). It is believed that the crude distillation of roses for the oil was originated from Persia in the late 7th century AD, and spread to the provinces of Ottoman Empire later in the 14th century (Boskabady et al., 2011).

Rose water is distilled in simple stills; thousands of roses are required to produce a pint-bottle of rose water (Nadkarni, 1954). The rose water was scattered at weddings to ensure a happy marriage and are a symbol of love and purity and are also used to aid meditation and prayer. Some evidence indicates that the origin of rose water is Iran, but the origin of its fragrant oil and extracts is Greece (Boskabady et al., 2011).

Roghan-e-Gul is the oil prepared from the rose (*Rosa damascena* Mill). The oil is reddish in color with bad taste (Najmul Ghani, 2011).

#### Method of preparation of *Roghan-e-Gul*

There are two methods of preparation of Roghan-e-Gul. One which is prepared in sunlight is known as Roghan-e-Gul Kham or Roghan-e-Gul Aftabi and which is prepared on fire is known as Roghan-e-Gul Matbookh or Roghan-e-Gul Aatishi (Lubhaya, 1982; Kabiruddin, YNM).

In one method, Roghan-e-Zaitun or Roghan-e-Kunjad is taken as base, fresh petals of the rose flower are added and are placed in a glass jar in sun light till the color of the petals changes from red to white. Then the petals are separated from the oil (Najmul Ghani, 2011). Another method is that fresh petals of a rose flower is added in Roghan-e-Zaitun or Roghan-e-Kunjad and is placed in sun light when the color of petals changes it is replaced by another fresh flowers. This process is repeated for at least 3-7 times (Najmul Ghani, 2011; Lubhaya, 1982). This type of Roghan-e-Gul is prepared in 20 days in summer and 40 days in the winter season (Najmul Ghani, 2011). Roghan-e-Gul prepared by this method is known as Roghan-e-Gul Kham (Najmul Ghani, 2011) or Roghan-e-Gul Aftabi (Kabiruddin, YNM;

Lubhaya, 1982). In the second method, equal quantity of fresh petals of rose flower and Roghan-e-Zaitun or Roghan-e-Kunjad is heated on fire till the watery part is dried then it is separated (Najmul Ghani, 2011) or joshanda of flower is added in Roghan-e-Zaitun or Roghan-e-Kunjad and is heated on gas till watery part is dried and is used as Roghan-e-Gul (Lubhaya, 1982). Roghan-e-Gul prepared by this method is known as Roghan-e-Gul Matbookh (Najmul Ghani, 2011) or Roghan-e-Gul Aatishi (Lubhaya, 1982; Kabiruddin, YNM).



*Gul-e-Surkh*

#### Description

*Rosa damascena* Mill (F-Rosaceae) is a small and aromatic plant, which appears in spring (Yassa et al., 2009). It is an erect shrub, up to 2 m in height, Branches long, arching (Chatterjee and Pakrashi, 1992).

**Stem:** The stem is usually with numerous stout and hooked prickles, sometimes mixed with glandular bristles (Kirtikar and Basu, 1991).

**Leaves:** The leaves are pinnate, stipules adnate (Chatterjee and Pakrashi, 1992) and scarcely dilated stipules. Leaflets are usually 5- 7 in number and 2.5-6.3 cm long, ovate-oblong, serrate, more or less pubescent beneath (Kirtikar and Basu, 1991).

**Flowers:** There are several flowers, arranged in a corymb, double, pink, red or white, born on glandular-hispid and prickly pedicles, sweet-scented (Chatterjee and Pakrashi, 1992) and sometimes striped. The flowers are bitter and sweetish (Kirtikar and Basu, 1991).

**Pedicles:** The pedicles and receptacles are glandular-hispid (Kirtikar and Basu, 1991).

**Sepals:** The sepals are deciduous, reflexing during flowering time (Kirtikar and Basu, 1991).

**Fruit:** The fruits are obovate (Kirtikar and Basu, 1991) or ovoid, bristly, pulpy and bright red (Chatterjee and Pakrashi, 1992).

#### Habitat

Several species are cultivated in India. *Rosa damascena* is cultivated in rose gardens in several places in Bengal, Kashmir, Punjab, chiefly near Patna and Ghazipur.

Enormous quantities of wild hill roses grow throughout the North West Himalayas and Kashmir (Nadkarni, 1954). This plant is cultivated in all over the world including Iran, Europe, Bulgaria, Turkey and India. The major cultivation areas of *Rosa damascena* in Iran are Kashan, Fars and Azerbaijan, among them Kashan is the most famous one (Boskabady et al., 2011).

#### Vernacular names

The plant is known by different vernacular names in different language, areas and traditions: Gul, Gulab, Gulal (Afghanistan); Warde ahmar (Arabic); Golap-phul (Bengali); Gul, Gulab, Sudburg (Bombay); Gulabi huvu (Canada); Panniru, Tarana (Canarase); Roser de Alexandria (Catalan); Damask or Persian Rose, Bussora Rose, Damascus Rose, Damask Rose, Persian Rose (English); Rose de Damas, Rosier purgative, Rosier de Puteaux, Rosier des quatresaisons, Rosier de tous les mois (French); Gulabnu-phul (Gujrati); Gulab, Sudburg, Gulab ka phool (Hindi); Gulabshavante (Kon); Panniruppu, Penimirpushpam (Malayalam); Wardatal hall, Wardatal Madonna, Warda ta malta (Malta); Gulab (Marathi); Gul, Gulesurkh, Gulisurkh (Persian); Rosa Kazanlikskaya (Russian); Atimanjula, Lakshapushpa, Mahakumari, Shatadala, Shatapatri, Shatapatrika, Soumyagandha, Sumana, Sushita, Suoritta, Satapatri (Sanskrit); Gulgulab (Sibi); Rosal de Alejandria, Rosal de Damasco, Rosalino de olor (Spanish); Golappu, Rojappu, Irosa (Tamil); Rojapuvu, Gulabi, Panniru, Roja (Telugu); Gulab (Urdu); Aud, Jojam (Unani) and Bosoragolabo (Uriya) (Ibn Baitar, 2003; Kirtikar and Basu, 1991; Nadkarni, 1954).

#### Mizaj (Temperament)

Unani physicians described the Mizaj of Roghan-e-Gul as Murakkabul Quwa (Najmul Ghani, 2011; Lubhaya, 1982). According to Ibn Sina, it is Mail baEtedal (Najmul Ghani, 2011). Unani physician Masihi described that the Mizaj of Gulab is cold in 1st degree and dry in 2nd degree (Ibn Baitar, 2003) while few others described it as Murakkabul Quwa (Ansari, 2009).

#### Afa'al (Actions)

In classical Unani literature, various actions of Gul-e-Surkh (*Rosa damascene* flower) have been described in details such as qate baah, mushil, muskkin-e-khumar, mufatteh, qat-e-massa, mubarrid iltehab-e-sar, mufattehsudad-e-jigar (Ibn Baitar, 2003), muqawwi-e-dimag, muqawwi-e-qalab, muqawwi-e-fam-e-meda, hazim, muhallil-e-warm, muhallil-e-riyah, musakkin-e-safra, musakkin-e-balgham (Kabiruddin, YNM), mufarreh, rade, muqawwi-e-meda, muqawwi-e-jigar (Takmeeli, 1987).

Roghan-e-Gul possesses rade, habis, qabiz, muhallil, mufatteh, muhallil-e-auram, muqawwi-e-dimag,

musakkin and mushil properties (Abdul Hakim, 1999; Najmul Ghani, 2011).

#### Istemaal (Uses)

Gul-e-Surkh (*Rosa damascene* flower) therapeutically used in various diseases such as dar-e-sar, dard-e-chashm, dard-e-uzan, dard-e-maqad, dard-e-lissa, dard-e-ama' amustaqeem, dard-e-rahem, dard-e-meda, martooob mizaj meda, surkhbadah, kharish, zakham, nafasud-dam, ishal, sudda-e-jigar, amraz-e-halaque, zukam, khafqan, ghashi and qulae dahan. Rose is very effective to heal injuries of groin and axillary region. Isa bin Masa stated that rose, rose oil and rose water are all works as tonic to organs. Ishaque bin Imran mentioned that rose is very beneficial for stomach and liver. It helps to open the obstructions of liver caused by excessive heat. Gargling of mixture made by rose and honey is very effective in throat problems. Local application of paste of rose powder helps to expel out placenta and ka'anta (Ibn Baitar, 2003). Locally paste on face helps to clear facial skin and pimples (Lubhaya, 1982). Use of Gulqand in empty stomach followed by hot water drink is very effective in excessive ratubat-e-meda. Razi advised prohibition of its use to person suffering from hot temperament and inflammatory diseases especially in summer as it produces more heat and thrust. Ahmad bin Khalid said that use of Arque Gulab with Shakar Tabrizad is very effective to cure acute fever, thrust and inflammation of stomach (Ibn Baitar, 2003).

Application of Nutool of Roghan-e-Gul alone or along with vinegar and rose cures headache and acts as brain tonic (Abdul Hakim, 1999; Najmul Ghani, 2011) and cures insomnia and meningitis. Its local application on head, its inhalation and instillation in nose also relieves headache. On oral administration it excretes the safrawi dast through stool. Its oral intake cures safrawi dast (bilious dysentery), gastritis and intestinal wound. Its local application cures blepharitis, stomatitis and oral thrush caused by lime chewing. It is applied on the wounds of small pox, also helpful in burns when used along with egg yolk. Cloth wet with rose oil is applied on scalp to cure insomnia. Instillation of rose oil in ear is beneficial in toothache, headache and dryness of brain. Its gargle also helps to reduce toothache (Najmul Ghani, 2011).

#### Muzir (Adverse effect)

Gul-e-Surkh and Roghan-e-Gul both have the adverse effect on baah (libido) (Abdul Hakim, 1999; Anonymous, YNM; Lubhaya, 1982).

#### Musleh (Corrective)

Marzanjosh and Anisoon are used as corrective for the adverse effect of Gul-e-Surkh (Anonymous, YNM) while

Anisoon and Roghan Badam Shireen are used as corrective for the adverse effect of Roghan-e-Gul (Abdul Hakim, 1999).

Badal (Substitute)

Banafsha is used as the substitute of Gul-e-Surkh (Anonymous, YNM) while Roghan-e-Banafsha is used as a substitute of Roghan-e-Gul (Kabiruddin, YNM).

Miqdar Khorak (Dose)

Gul-e-Surkh: 5-7 gm (Lubhaya, 1982)

Roghan-e-Gul: 7 gm - 1 Tola (Lubhaya, 1982)

Pharmacological actions

(As described in ethnobotanical and traditional literature)

The drug *Rosa damascene* Millis described in detail in ethnobotanical and scientific literature and various actions have been reported to possess it. Some pharmacological actions and therapeutic uses are as follows:

*Rosa damascena* possesses appetizing, aromatic properties (Chatterjee and Pakrashi, 1992). It is mildly astringent, aperient, carminative, refrigerant and cardio tonic (Nadkarni, 1954).

Flowers are astringent and tonic in nature (Chatterjee and Pakrashi, 1992). The Unani physician stated that flowers showed laxative, expectorant, and cardiotoxic properties but Ayurvedic physician experienced it as cooling, laxative, aphrodisiac and antipyretic (Kirtikar and Basu, 1991).

Buds are most astringent than the expanded flowers, so buds are preferred for medicinal use. They are considered to be cold and dry, cephalic, tonic and aperient (Kirtikar and Basu, 1991). It has also cardiotoxic, expectorant and laxative properties (Chatterjee and Pakrashi, 1992).

Petals are astringent; stamens are hot, dry and astringent (Kirtikar and Basu, 1991).

Therapeutic uses

Rose plant is used for the treatment of many complaints and described in details in ethnobotanical literature and various uses have been reported as a sore throat, enlarged tonsillitis, fattening to women and old people, uterine hemorrhages and urticaria. Locally they are applied to cure aphthae (Nadkarni, 1954). 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. This

plant is also used as a gentle laxative (Boskabady et al., 2011).

Flowers of the plant are good for eyes. It relieves a headache, toothache, stomatitis, benefits the lungs, kidney, and liver. It is also used in heat of body, chronic fever, inflammations, and intestinal affection and to reduce excessive perspiration (Kirtikar and Basu, 1991). Gulqand and syrup made by the rose petals have mild laxative property. In the Unani system of medicine, gulqand 5 tolas, anisi seed 6 Masha and sikanjabeen sirka 2 tola are used in urticaria (Nadkarni, 1954). Gulqand is considered tonic and fattening (Chopra et al., 1956), mostly used by women and old people (Kirtikar and Basu, 1991).

Buds are used for removing bile and cold humor (Kirtikar and Basu, 1991).

Rose oil or attar is freely used as perfume. It is also used as a flavoring agent to mask the taste of many obnoxious preparations (Nadkarni, 1954). 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 (Boskabady et al., 2011).

Rose water forms an agreeable vehicle for the preparations of lotions and collyrin (Nadkarni, 1954).

North American Indian tribes used a decoction of the root of *Rosa damascena* plant as a cough remedy to ease children's cough (Boskabady et al., 2011).

Phytochemistry

Volatile essential oil, fat, resin, malic tartaric and tannic acids are derived from the plant of *Rosa damascena* (Nadkarni, 1954). It also has long chain conjugated alkaloids, stigmasterol,  $\beta$ -sitosterol, 3-ep-dehydroabiatic acid, 6-methyl-5-heptane-2-one, pectolarigenin, quercetin, kaempferol and its 3-O- $\beta$ -D-glucopyranoside and 3-O- $\beta$ -D-galactoside,  $\alpha$ , $\beta$  and  $\delta$ -damascones (Chatterjee and Pakrashi, 1992). Quercetin, Kaempferol & cynidine are also derived from the whole plant (Rastogi and Mehrotra, 1993).  $\alpha$ -copaene, n-nonacosanol, n-dotriacontanol, farnesol, geranyl acetone, nerotoxide, caryophyllene epoxide, neryl laurate and methyl geranate have been detected by GLC in Bulgaria rose concrete, average and highest oil contents of roses from India and North Africa was estimated as 0.041, 0.051 and 0.051, 0.08% respectively. Edward rose absolute contained geraniol (11.0), citronellol (4.0) & phenylethyl alcohol (56.0%) (Rastogi and Mehrotra, 1993).

Rose flowers contain essential oil: citronellol, nerol, geraniol,  $\beta$ -phenyl ethanol and its glucoside, eugenol

and methyl eugenol; organic acids, chlorogenic acid, tannin, cyanin, cyaniding and its 3,5-di-glucoside, quercitrin, carotene and sugars (Chatterjee and Pakrashi, 1992).  $\beta$ -phenethyl  $\beta$ -D-glucopyranoside (1.0%) is also isolated from the flowers (Rastogi and Mehrotra, 1993). Petals of red rose contain an aromatic volatile oil, a glucoside quercitrin gallic acid quercitannic acid and red coloring matter (Nadkarni, 1954).

Citronellol, nerol, geraniol,  $\beta$ -phenyl ethanol, eugenol, methyl eugenol,  $\beta$ -sitosterol, pectolarigenin, kaempferol-3-O-glucoside and kaempferol-3-O-galactoside is isolated from the root of *Rosa damascena* (Rastogi and Mehrotra, 1995).

Stamen: 2-Hydroxyursolic acid,  $\beta$ -amyryn & methyl ursolate isolated from stamen. Lycopene, rubixanthin, zeaxanthin, xanthophyll, and taraxanthin have been isolated from the hips (Chatterjee and Pakrashi, 1992).

#### Pharmacological studies

A number of studies have been carried out on *Rosa damascena* Mill in recent years showing that it possesses diverse pharmacological actions. Some of the important pharmacological actions are as follows:

##### Analgesic

An experimental study was designed to evaluate the analgesic effect of aqueous, ethanol and chloroform extracts of rose in mice on the hot plate and tail flick tests. The result reveals that only ethanolic extract showed analgesic effect (Rakhshandeh et al., 2008).

The analgesic activity of hydro-alcoholic extract and essential oil of *Rosa damascena* in mice was demonstrated in acetic acid, formalin and tail flick tests. It was found that essential oil of the plant failed to show any analgesic effect. However, the hydro-alcoholic extract has a potent analgesic effect in acetic acid and formalin tests but no effect on tail flick test (Hajhashemi et al., 2010).

##### Antiaging

The effect of a rose flower extract was evaluated on the mortality rate of *Drosophila melanogaster* in recent years. 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* (Jafari et al., 2008).

#### Antibacterial

The present study was undertaken to investigate the effects of water and acetone extracts of *Rosa damascena* Miller petal against *E. coli* and *B. subtilis*. Acetone extract having highest antibacterial activity than water extract. The acetone extract shows the significant antibacterial activity against Gram positive and Gram negative bacteria like *E. coli* and *B. subtilis* compared to aqueous extract (Kurahdeet et al., 2011).

Antibacterial activity of rose (*Rosa damascena*) essential oil has been reported against *E. coli*, *Pseudomonas aeruginosa*, *B. subtilis*, *Staphylococcus aureus*, *chromo bacterium violaceum* and *erwinia carotovora* strains. Among them, *C. violaceum* was most sensitive to rose essential oil and absolute and *E. coli* was also sensitive to the rose essential oil. The result exhibits that rose showed antibacterial activity against both gram-positive and gram-negative bacteria (Ulusoy et al., 2009).

A study was designed to evaluate the antimicrobial activity of aqueous extracts from *Rosa damascena* against 10 pathogenic microorganisms. The result showed that hexane extracts have very low activity against test microorganisms; ethanol and water extract significantly exhibited antimicrobial activity and inhibited the growth of gram positive and gram negative bacteria. Minimum inhibition concentration (MIC), Minimum bactericidal concentration (MBC) and the diameter of inhibition zone (DIZ) were determined against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Pseudomonas*, *Acinetobacter calcaoeuticus*, *Salmonella enteritis* and *Aspergillus niger* (Halawani, 2014).

The antibacterial activity of oil of *Rosa damascena* petals was evaluated against three strains of *Xanthomonas axonopodis* spp. *vesicatoria*. The result indicated that the essential oil remarkably inhibited the growth of the tested strains of *X. axonopodis vesicatoria* (Basim and Basim, 2003).

An experimental study was carried out to evaluate the antibacterial activity of both fresh and spent flower extracts of *Rosa damascena* against 15 species of bacteria *Aeromonas hydrophila*, *B. cereus*, *Enterobacter aerogenes*, *Enterococcus faecalis*, *E. coli*, *Klebsiella pneumonia*, *Mycobacterium smegmatis*, *Proteus vulgaris*, *Ps. aeruginosa*, *Ps. fluorescens*, *Salmonella enteritidis*, *Salmonella typhimurium*, *Staph. aureus* and *Yersinia enterocolitica*. Both extracts were effective against all the bacteria except *E. coli*. Although the fresh flower extract was more effective than the spent flower extract. Fresh and spent flower extracts showed the strongest effects against *S. enteritidis* and *M. smegmatis*, respectively (Ozkan et al., 2004).

In Vitro antibacterial activities of essential oil of *Rosa damascena* was evaluated by disk diffusion method against *E. coli*, *Staph. aureus* and *Ps. aeruginosa*. The finding of the study exhibited that it has antimicrobial activity against *Staph. aureus* (Aridoğan et al., 2002).

Essential oils of several plants including *Rosa damascena* were studied for their antimicrobial activity against gram-positive *Staph. Aureus* (ATCC 25923), gram-negative *E. coli* (ATCC 25922), gram-negative *Ps. aeruginosa* (ATCC 27853), and yeast *Candida albicans* (ATCC 14053). The finding of the result reveals that tested essential oils exhibited inhibitory and bactericidal activities against all tested microorganisms at low concentrations (Lisin et al., 1999).

A study reported the antibacterial activity of citrenellol, geraniol, and nerol that are the major components of rose oil (Aridoğan et al., 2002; Gochev et al., 2008). Antibacterial properties of absolute rose could be attributed to its high phenyl ethyl alcohol content. The antimicrobial properties of alcohols have been known for a long time (Etschmann et al., 2002).

#### Anticonvulsant

The essential oil of *Rosa damascena* in acute pentylene tetra zole (PTZ) induced the seizure in rats delays the start of epileptic seizures and decrease the duration of tonic-clonic seizures (stage 4) (Kheirabadi et al., 2008; Ramezani et al., 2008). In the chronic model of PTZ induced seizure, this plant also caused prolongation of latent periods before tonic clonic generalized seizures (Kheirabadi et al., 2008).

A study was carried out to evaluate the efficacy of rose essential oil injection given 30 minutes before amygdale electrical kindling. The result reveals that it reduced the appearance of 1st, 2nd, 3rd, 4th, and 5th stages of seizure and also reduces the time after discharge duration. It is suggested that essential oil of *Rosa damascene* retarded the development of behavioral seizures in amygdale electrical kindling and possesses the ability to counteract kindling acquisition (Ramezani et al., 2008).

The effects of the essential oil of *Rosa damascene* as an adjunct in the treatment of children with refractory seizures were also studied and showed a significant reduction in the mean frequency of seizures in patients using essential oil of the plant. Therefore, the essential oil of *Rosa damascena* has beneficial antiepileptic effect in children with refractory seizures (Ashrafzadeh et al., 2007).

The mechanism of anticonvulsant effect of essential oil of *Rosa damascena* cannot be explained by the observed results. It can be suggested that the flavonoids may be involved in this effect. It is reported that

flavonoids act on the GABAergic system in the brain. Flavonoids can also enhance the effect of benzodiazepines on GABA receptors (Kheirabadi et al., 2008). Other components of essential oil of *Rosa damascena* such as geraniol and eugenol have also been shown to have the antiepileptic effect (Wei et al., 1997).

#### Antidepressant

A study was carried out to evaluate the antidepressant activity of aqueous extract of *Rosa damascena*. In this study forced swimming test was used and the duration of immobility time and swimming time of three doses of aqueous extract (15, 60, and 90 mg/ kg) in comparison with saline (negative control) and imipramine (positive control) was evaluated. The result showed that the two high doses of aqueous extract (60 & 90 mg/ kg) had no significant effect on these parameters while its low dose (15 mg/ kg) had significantly increased swimming time and decreased immobility time which suggests that the low dose of the extract possess antidepressant like activity (Dolati et al., 2011).

#### Antidiabetic

In this study, browning process was applied to rose flower to determine whether the processed or non processed rose flower has an antidiabetic effect on the streptozotocin induced diabetic mouse. Aqueous extracts of processed and non processed rose flowers were analyzed using liquid chromatography/ mass spectrometry. The results show that the polyphenol content decreased with browning. The hemoglobin A1c level, an indicator of long-term diabetes, in diabetic mice after administration of extracts of browned rose flowers for 24 and 48 h were lower than those after administration of extracts of non-browned rose flowers. Moreover, the activity of aspartate transaminase, which is often high in diabetic patients, was low in all groups treated with rose flowers, whether they were non-browned or browned. Taken together, these results indicate that extracts from red rose flowers have long-term anti-diabetic effects and that this effect is independent of the level of polyphenols in the extract (Juet et al., 2014).

In a study, it was found that *Rosa damascena* exerts 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 of acarbose. It was also found that *Rosa damascena* is a potent inhibitor of the  $\alpha$ -glucosidase enzyme (Gholamhoseinian et al., 2008). Antidiabetic 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 (Gholamhoseinian et al., 2009).

#### Anti-HIV

An In Vitro study was carried out to evaluate the effect of water and methanol extracts of *Rosa damascena* on HIV infection. The Anti-HIV activity of the nine compounds including a new compound 2-phenyl ethanol-O-(6-Ogalloyl)- $\beta$ -D-glucopyranoside which was purified from the methanol extract was evaluated on C8166 human T lymphoblastoid cells infected with HIV-1MN and H9 human T-cell lymphoma cells chronically infected with HIV-1IIIB. Kaempferol 1 and its 3-O- $\beta$ -D-glucopyranosides 3 and 6 exhibited the greatest activity against HIV infection of C8166 cells, whereas kaempferol-7-O- $\beta$ -D-glucopyranoside showed no effect. Similarly, quercetin-7-O- $\beta$ -D-glucopyranoside was inactive compared to quercetin 2. Compound 8, a new natural product exhibited some anti-HIV activity, presumably due to the presence of the galloyl moiety since 2-phenyl ethanol-O- $\beta$ -D-glucopyranoside was inactive. The study reveals that the anti-HIV activity of the crude extract is due to the combined effects of different compounds acting additively against different stages of virus replication (Mahmood et al., 1996).

#### Antihypertensive

Recently, a new compound named cyanidin-3-O- $\beta$ -glucoside was isolated from the buds of *Rosa damascena*. This compound can significantly suppress angiotensin-I converting enzyme (ACE) activity. Because ACE is a key enzyme in the production of angiotensin-II, *Rosa damascena* may be effective to improve the cardiovascular function (Kwon et al., 2010).

#### Anti-inflammatory

The anti-inflammatory effect of essential oil and hydro alcoholic extract of *Rosa damascena* was evaluated on rat paw edema induced by carrageenan. The result reveals that 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 (Maleev et al., 1972).

#### Antilipase

In a recent study, the anti-lipase effect of the extracts of several plants including *Rosa damascena* was studied. The finding reveals that the ethanolic extract of *Rosa damascena* possesses anti lipase activity (Gholamhoseinian et al., 2010).

#### Antioxidant

The antioxidant activity of the phenolic compound in the ethanolic extract was determined. It was compared to standard antioxidant L-ascorbic acid by 1, 1-diphenyl-2-picryl hydroxyl (DPPH) free-radical method. The study showed that *Rosa damascena* has high antioxidant activities (Kumar et al., 2009).

The antioxidant activity of hydroalcoholic extract of petals and essential oil of *Rosa damascena* was 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 the existence of quercetin 3-O-glucoside and other flavonoids in the extract (Yassa et al., 2009).

An experimental study was carried out to determine the antioxidant activity of hydroalcoholic extract of petals and essential oil of *Rosa damascena* using free radical scavenging activity with 2,2-diphenyl, 1-picrylhydrazyl (DPPH) and lipid peroxidation (ferric ammonium thiocyanate) methods. The hydroalcoholic extract showed strong free radical scavenging capacity compared to lipid peroxidation inhibitory effects. IC50 values of the extract were 2.24  $\mu$ g/mL and 520  $\mu$ g/mL in free radical scavenging and lipid peroxidation assays, respectively. The major components of essential oil were Linalool (3.8%), nerol (3.05%), geraniol (15.05%), 1-nonadecene (18.56%), n-tricosane (16.68%), hexatriacontane (24.6%) and n-pentacosane (3.37%). The bioassay-guided fractionation of extract led to the isolation of three flavonol glycosides: quercetin-3-O-glucoside, kaempferol-3-O-rhamnoside, and kaempferol-3-O-arabinoside. The IC 50 value of the radical scavenging activity of kaempferol-3-O-rhamnoside which was, 530  $\mu$ g/mL was weaker than the extract. It was concluded that the petal of this cultivated rose has no bitter taste and because of its potential antioxidant activity and good taste, can be used as food flavor and a preventing agent for many diseases (Yassa et al., 2009).

The antioxidant activity of both fresh and spent flower extracts of *Rosa damascena* was carried out. The result exhibited that the antioxidant activity of fresh flower extract was higher than that of spent flower extract (Ozcan et al., 2004).

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

$\alpha$ -tocopherol and suggest that the plant can be considered as a medical source for the treatment and prevention of many free radical diseases (Shahriari et al., 2007).

#### Antispasmodic

A study was designed to determine the efficacy of *Rosa damascena* extract on primary dysmenorrhea. The participants received two capsules of mefenamic acid and *Rosa damascena* with the similar physical properties in two consecutive cycles per 6 hours for 3 days in a cross-over form. The result exhibited that *Rosa damascena* and mefenamic acid had similar effects on the intensity of pain in primary dysmenorrhea (Baniet al., 2014).

#### Antitussive

An experimental study was carried out to evaluate the antitussive effect of the ethanolic and aqueous extract of *Rosa damascena* in guinea pig model. It was compared with the standard drug codeine. It was found that the antitussive effect of the ethanolic extract was greater than the aqueous extract. It is assumed that both extracts relieve a cough by suppressing cough center in central nervous system (Shafei et al., 2003).

#### Cardiac stimulant

The result of a study reveals that 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 (Boskabady et al., 2011).

#### Dementia

An active constituent of the chloroform extract of *Rosa damascena* was isolated which is a very long polyunsaturated fatty acid (VLFA) having molecular formula C<sub>37</sub>H<sub>64</sub>O<sub>2</sub>. This isolated compound protected atrophy induced by A $\beta$  (25-35) and displayed strong neurite outgrowth activity. The effect of this compound on the length of dendrite in the treated cells was comparable to those of nerve growth factor (NGF). Therefore, *Rosa damascena* may have the beneficial effect in patients suffering from dementia (Awaleet al., 2011).

#### Hypnotic

A study was carried out to evaluate the hypnotic effect of the ethanolic and aqueous extract of *Rosa damascena* in mice in a dose of 500 and 1000 mg/kg respectively. The result shows that a significant increase in phenobarbital induced sleeping time was noticed in comparison to diazepam (Rakshanda and Hosseini, 2006).

#### Ileum contraction

The effect of various concentrations (0.66, 0.83, and 1.3 mg/ml) of aqueous fraction of the ethanolic extract of *Rosa damascena* on contractions of isolated guinea pig ileum in comparison with acetylcholine in presence and absence of atropine, a muscarinic antagonist of cholinergic, was evaluated. The response of ileum to 1  $\mu$ g/ml of acetylcholine was considered as 100% response. Results showed that aqueous fractions dose dependently increased basal guinea pigs ileum contractions. Maximal contraction of fraction (1.3 mg/ml) induced 23.4 % of maximal Ach response. The contraction of the ileum to aqueous fraction was significantly decreased in presence 0.001  $\mu$ g/ml of atropine. It is concluded that aqueous fraction of *Rosa damascena* has the mild excitatory effect on ileum contraction and this fraction may be beneficial as a mild laxative agent (Dolatiet al., 2013).

#### Laxative and prokinetic

Gavage of boiled extract of *Rosa damascena* in rats showed significant laxative effects (increasing feces water content and the frequency of defecation). Because intraperitoneal injection of extract showed symptoms of constipation (no feces in 24 hr), it seems that laxative effects are partly due to osmotic infiltration of fluids into intestinal lumen (Arezoomandan et al., 2011).

#### Ophthalmic disorders

The effect of a herbal eye drop preparation (Ophthacare®) containing different herbs including *Rosa damascena* in patients suffering from various ophthalmic disorders namely, conjunctivitis, conjunctival xerosis (dry eye), acute dacryocystitis, degenerative conditions (pterygium or pinguecula), and postoperative cataract patients were studied. An improvement was observed after receiving the herbal eye drop treatment in most of the cases. These results showed that herbal eye drop, Ophthacare®, has a useful role in a variety of infective, inflammatory and degenerative ophthalmic disorders (Biswas et al., 2001).

#### Reflux esophagitis

The effect of the polyherbal formulation consisting of seven medicinal plants namely *Aegle marmelos*, *Elettaria cardamomum*, *Glycyrrhiza glabra*, *Citrus aurantifolia*, *Rosa damascena*, *Cissus quadrangularis*, and *Saccharum officinarum*, was evaluated on experimentally induced reflux esophagitis and gastrointestinal motility in animals. The study indicated that the polyherbal formulation has the protective effect against surgically induced reflux esophagitis which may be due to its gastro protective, antioxidant, and prokinetic activity (Sengottuveluet al., 2008).



## Respiratory system

A study was carried out to determine the efficacy of ethanolic extract and essential oil on the tracheal smooth muscle of guinea pig contracted by KCl and methacholine. The results showed a potent relaxant effect of extract and essential oil that was comparable to that of theophylline (Boskabady et al., 2006).

In a study, the relaxant effect of aqueous, ethyl acetate and n-butanol fractions of *Rosa damascena* on the tracheal smooth muscle of guinea pig was determined. The results showed more potent relaxant effect of ethyl acetate fraction on tracheal smooth muscle compared to theophylline, while the effect of the aqueous and n-butanol fraction was relatively weak. The greater relaxant effect of ethyl acetate fraction compared to the other two fractions suggests that lipid soluble (nonpolar) constituents of this plant are mainly responsible for its relaxant effect on tracheal smooth muscle. The results also suggest an inhibitory effect of aqueous and acetyl acetate fractions on muscarinic receptors (Rakhshandeh et al., 2010).

## Toxic effect

A study was designed to determine the toxicity of *Rosa damascena*. In order to preliminarily study the probable toxic effect, its infusion was orally administered to 5 groups of 5 dogs at doses 0.5-8 times that of human use in traditional medicine (90-1440 mg/kg/d) for 10 successive days. The dogs in the control group (n=4) received placebo. Serum levels of urea, creatinine, alkaline phosphatase (ALP), alanine aminotransferase (ALT), bilirubin, albumin, and protein were measured in all experimental groups at days 0, 1, 3, 7 and 10. Except for a transient increase in bilirubin levels (day 3) and a rise in serum ALT at day 10, both with the highest dose of the treatment, there were no statistical differences between different experimental groups compared to the control. The results suggest minimal nephrotoxic or hepatotoxic effects for the infusion of *Rosa damascena*. However, the medication may be hepatotoxic at extraordinary high doses (Akbari et al., 2013).

## CONCLUSION

The flowers of *Rosa damascena* Mill (Gul-e-Surkh) have been in use since times immemorial to treat the wide range of indications. It has been subjected to quite extensive phytochemical, experimental and clinical investigations. Experimental studies have demonstrated its analgesic, anti-aging, antibacterial, anticonvulsant, antidepressant, antidiabetic, anti-HIV, antihypertensive, anti-inflammatory, antilipase, antioxidant, antispasmodic, antitussive, cardiac stimulant, hypnotic, laxative and effect in dementia, ileum contraction, ophthalmic disorders, reflux

esophagitis and respiratory system. It has no toxic effect on vital organs. The scientific studies have proved most of the claims of traditional medicines. However, further, detailed clinical research appears worthwhile to explore the full therapeutic potential of this plant in order to establish it as a standard drug.

## CONFLICT OF INTEREST

None declared.

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