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Review

# A systematic review of the efficacy and safety of *Rosa damascena* Mill. with an overview on its phytopharmacological properties

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ABSTRACT

*Rosa damascena* Mill. is one of the most famous ornamental plants cultivated all over the world mostly for perfumery industries. Traditionally it has been used as an astringent, analgesic, cardiac and intestinal tonic.The paucity ofauthoritative monographs urged usto summarize its clinical effectiveness and safety with acomprehensive review of the literature.

"PUBMED", "SCOPUS", "WEBOF SCIENCE" were searched up to April 30, 2017 with search terms:("*Rosa damascena*" OR "Damask Rose"). All human studies with any mono-preparation were included. In vitro and animal studies from "PUBMED"were also reviewed and outlined.

Of "1000" identified publications, twelveeligibleclinical trials were retrieved. Antimicrobial, anti-inflammatory, antioxidant, anticancer, protective neuronal, cardiac, gastrointestinal and hepatic effectsin 30 *in vitro* and 21 animal studies were also shown. there are promising evidences for the effectiveness and safety of *Rosa damascena* Mill in pain relief, but confirmatory studies withstandardized products is suggested.

## 1. Introduction

In the early years of the twenty first century, as the prevalence and morbidity of chronic diseases increased, it became more important to explore new treatment methods.[1] Herbal medicine is one of the most popular and ancient ways of treating ailments and has come under scientific investigations.[2,3] One important question is whether herbalism is effective and safe, therefore systematically conducted reviews answer relevant questions. *Rosa damascena* Mill. *(R.damascena),* known as Damask rose, a perennial bushy shrub, is the most famous ornamental plant of the Rosaceae family worldwide, in terms of perfumery and food industries.[4] Although the essential oil of Damask rose is thoroughly documented in herbal references,[5,6] hardly could it be detected in European authoritative monographs.[7,8] This may be due to its greater popularity in the eastern part of the world, where it has long been used traditionally as a herbal medicine.[9] Historically, Damask rose originated from the middle east and was then brought to Europe.[10,11] Oil extraction by crude distillation of roses probably began in Persia in the late 7th century AD, and was later developed in the provinces of the Ottoman Empire.[12] For a very long time, Damask rose has been very important in traditional polyherbal formulations.[13] More than one thousand years ago Avicenna (980–1037 AD)[14] described the various medical benefits of Damask rose such as its gastrointestinal and cardiac tonic effects, cosmetic properties in eliminating the unpleasant odor of sweat, repair of skin and mucosal lesions and he also mentioned its antinociceptive and anti-inflammatory virtues.[15] Later, Aghili Shirazi (1670-1747 AD)[16] in his famous book "Storehouse of Medicaments" discussed its medicinal effects as a brain tonic and pain killer in a variety of diseases.[17] Today, *R.damascena* is largely cultivated all over the world mostly in Turkey and Bulgaria as a result of its fragrances, flavourings and medicinal properties.[4,18] It is also massively harvested from gardens in Iran, India, China, northern African countries and Europe.[18] Different products such as rose oil, rose water, dried petals and hips of the plant are commercially derived and consumed. Alcoholic, aqueous, hydro-alcoholic or other kinds of extracts from different parts of the plant mainly the flowers are also academically prepared for research.[11]

Pharmacological studies have shown the various health effects of *R.damascena* flowers which can mainly be attributed to its large amount of polyphenolic components. A wide range of phytochemicals including

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flavonoids, glycosides, terpenes, and anthocyanins have been isolated from different parts of the plant.[4,19] Vitamins C, A, B1, B2, B3, and K, citric acid, malic acid, pectin, tannins and carotenoids have also been reported.[20] Major active phenolic compounds are kaempferol, cyanidin 3, 5, D-glycoside, quercetin, and gallic acid.[19] β Citronellol, nonadecane, geraniol and henicosane are the main chemical constituents of its volatile oil.[21] Although different concentrations of rose oil components have been reported from different parts of the world,[10] few studies have compared the constituents of different extract types.[22–30] The total phenolic contents of the rose essential and absolute oil are higher than the hydrosol (water aroma). While phenyl ethyl alcohol is the major component of rose absolute[31] and rose water volatiles[29,30] citrenellol and geraniol constitute more than 55% of rose essential oil and hydrosol. The presence of much higher levels of some components in the hydrosol compared to the rose oil was remarkable such as geraniol: (30.74% versus 22.19%) and nerol:(16.12% versus 10.26).[31]

Apart from its pharmacological effects such as "hypnosis, analgesia, neuroprotection; anti-convulsion, cardioprotection, bronchodilatory, antimicrobial and digestive beneficial effects, anti-inflammation, antioxidation and anti-diabetes", few studies have surveyed its clinical efficacy and safety.[4,32–35] The aim of this review was to summarize the current evidence for the clinical efficacy and safety of *Rosa Damascena* Mill. with an overview on its phytopharmacological properties.

## 2. Methods

### 2.1. Search strategy

Systematic search was electronically conducted in following databases: PUBMED, SCOPUS and WEB OF SCIENCE, all from the inception date till the end of April 2017 to identify all published investigations on "*Rosa Damascena* Mill.". The database named "The plant list"[36] was previously searched and the synonyms and accepted names of the plant were checked. The selected search terms were ("*Rosa damascena*" OR "Damask Rose") without limiting search elements. In PUBMED database the search field was "Title/Abstract", in SCOPUS database was "Title/Abstracts/Keywords" and in WEB OF SCIENCE was "Topic". Furthermore handsearching the bibliographies of retrieved results and reviews to obtain additional relevant studies was performed.

### 2.2. Study selection

Two reviewers independently reviewed all the results and extracted data while meeting inclusion and exclusion criteria. All human studies with intervention of any mono-preparation of "*Rosa damascena*" OR "Damask Rose" were included. In vitro and animal studies investigating any pharmacologic effect of the plant extracts or its certain isolated constituents along with toxicologic studies were also selected from PUBMED database and included in relevant tables. Review articles, letters to the editor, book sections, unpublished data such as theses and publications without available English abstracts were excluded.

### 2.3. Data extraction

All the abstracts and related full texts of selected articles were reviewed and following items were extracted and summarized in relevant tables. In (Table 1) the following items of *in vitro* studies were extracted: 1) first author's name and the year of publication 2) the type of extracts 3) the recorded pharmacologic activities 4) the components if detected in the study 5) the related medical or biological effect 6) any suggested mechanism based on results of the study. In (Table 2) experimental studies in animals were extracted as follows: 1) first author's name and the year of publication 2) the target of the experiment 3) the type of extracts 4) doses/route of administration/study duration 5) main exhibited outcomes 6) adverse effects and after a slash(/) summarized biologic effect. For human studies in (Table 3) following items were included: 1) first author's name and the year of publication 2) the type of study and after a slash (/) the Jadad score identified for assessing the quality of the report based upon the Jadad scaling method.[37] 3) description of participants and their number and ages 4) the product or the extract type 5) doses/route of administration/duration of the intervention 6) study groups 7) major outcomes of intervention 8) any reported adverse effects and after a slash (/) any scientific definition or precious comment summarizing the study. Non-available data after email contacts to authors and not receiving responses were noted in tables as: "Full text not found".

## 3. Results

The preliminary search of databases have identified "1000" related publications. Twelve randomized controlled trials (RCTs) for any indication were reviewed as human trials and presented in Table 3. The flow-chart is outlined in Fig. 1. Any other type of clinical trials was not reported. Furthermore, "30" *in vitro* experiments and "21" animal studies were reviewed and outlined in Tables 1 and 2, respectively.

### 3.1. In vitro studies

#### 3.1.1. Antimicrobial activity

Multiple studies have demonstrated the antibacterial and disinfectant activity of *R. damascena Mill.* and indicated the role of large phenolic contents such as flavonoids, terpenoids and phenyl ethyl alcohol.[28,38–41] Zu et al. investigated the activity of several essential oils against *Propionibacterium acnes*.[42] and revealed the potent anti-acnea effect of *R. damascena* Mill. Shokouhinejad et al. noted its comparable effect with chlorhexidine against endodontic pathogens.[43] Mahmood et al. tested the isolated constituents of its methanolic extract against HIV virus and detected different antivirus mechanisms indicating the synergistic effect of components together in the whole plant.[44] It is notable that no antimicrobial effect of its hydrosol has been reported.[28] and anti-fungal activity was only detected by its aqueous extract against *Candida albicans*.[38]

#### 3.1.2. Anti-inflammatory activity

In Zaidi's study, 70% hydro-alcoholic extract of *R. damascena* Mill. with 100 μg/ml concentration exhibited potent inhibition on IL-8 secretion, in *Helicobacter pylori* infection.[45] Slavov et al. in (2013) introduced a water-soluble polysaccharide named (RP-1) from distilled rose petals of *R. damascena*. They noted its potent immunomodulatory effect on mice intestinal Peyer's patch cells and IL-6 producing activity from macrophages.[46] Three years later, Wedler et al. detected a significant decrease in gene expression and cellular protein secretion of pro-inflammatory biomarkers by polyphenolic fractions of rose oil distillation waste water.[47]

#### 3.1.3. Antioxidant activity

Various studies detected the anti-oxidative effect of *R. damascena* Mill. by 1,1-diphenyl-2-picryl hydrazyl (DPPH) assay.[23,26,48] A variety of polyphenolic compounds, mostly the glycosides of kaempferol and quercetin were derived from the methanolic extract and suggested as active antioxidative components and DNA protective agents.[23,26] However, after comparing the antioxidant properties of 10 medicinal plants, Moein et al. concluded and noted the DPPH radical scavenging effect of the ethanolic extract, as a consequence of existing non-phenolic compounds.[48] Sedighi et al. also demonstrated the antioxidant activity of a 70% hydro-alcoholic extract of Damask rose by the ferric thiocyanate method, 78% equivalent to rutin (a standard flavonoid compound).[22]

#### 3.1.4. Anticancer effects

Many studies presented the prominent cytotoxic effects of *R. damascena* Mill. methanolic extract.[49] and rose oils[42,50–52] against cancer