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Therapeutic Effects of *Rosa damascena* on Human Health

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Abstract

Rosa damascena (Damask rose) is an aromatic plant with a long history of use in perfumery, food, and traditional medicine. Its products, including essential oil, rose water, rose concrete, rose absolute, dried flowers, and experimental extracts, differ in their chemical composition and biological activity. This review evaluates the available evidence on the phytochemical characteristics, traditional uses, pharmacological effects, clinical applications, and safety of *R. damascena* products. Preclinical studies have reported antimicrobial, antioxidant, anti-inflammatory, analgesic, and neuropharmacological activities; however, the findings vary according to the preparation, dose, and experimental model. Human studies have shown some short-term improvements, particularly in pain, anxiety, and sleep. Nevertheless, small sample sizes, insufficient product standardization, and methodological differences among studies limit the generalizability of the available evidence. Findings related to dermatological, gastrointestinal, women's health, and cardiovascular outcomes remain specific to the product and route of administration investigated. Safety data are largely restricted to short-term use. Overall, *R. damascena* possesses promising biological properties, but stronger clinical studies using chemically characterized and standardized products are needed to establish its therapeutic value.

Keywords: *Rosa damascena*, Therapeutic effects, Phytochemical composition, Aromatherapy, Antioxidant activity

Rosa damascena'nın İnsan Sağlığı Üzerindeki Terapötik Etkileri

Öz

Rosa damascena (Şam gülü), parfümeri, gıda ve geleneksel tıp alanlarında uzun süredir kullanılan aromatik bir bitkidir. Uçucu yağ, gül suyu, konkret, absolüt, kurutulmuş çiçek ve deneysel ekstraktlar gibi farklı ürünleri kimyasal bileşim ve biyolojik aktivite bakımından birbirinden ayrılmaktadır. Bu derlemede, *R. damascena* ürünlerinin fitokimyasal özellikleri, geleneksel kullanımları, farmakolojik etkileri, klinik uygulamaları ve güvenliliğine ilişkin mevcut bilgiler değerlendirilmiştir. Preklinik çalışmalar antimikrobiyal, antioksidan, antienflamatuvar, analjezik ve nörofarmakolojik aktiviteler bildirmiştir; ancak sonuçlar kullanılan ürünün niteliğine, doza ve deney modeline göre değişmektedir. İnsan çalışmalarında özellikle ağrı, anksiyete ve uyku üzerine bazı kısa süreli olumlu sonuçlar elde edilmiştir. Bununla birlikte, sınırlı örneklem büyüklükleri, ürünlerin yeterince standartlaştırılmaması ve çalışmalar arasındaki yöntem farklılıkları, mevcut bulguların genellenmesini güçleştirmektedir. Dermatolojik, gastrointestinal, kadın sağlığı ve kardiyovasküler etkilerle ilgili kanıtlar ise incelenen ürüne ve uygulama biçimine özgüdür. Güvenlilik verileri büyük ölçüde kısa süreli kullanımlarla sınırlıdır. Sonuç olarak, *R. damascena* umut verici biyolojik özelliklere sahip olmakla birlikte, terapötik değerinin kesin olarak belirlenebilmesi için kimyasal açıdan tanımlanmış ve standartlaştırılmış ürünlerle yürütülen daha güçlü klinik çalışmalara ihtiyaç vardır.

Anahtar kelimeler: *Rosa damascena*, Terapötik etkiler, Fitokimyasal bileşim, Aromaterapi, Antioksidan aktivite

1. Introduction

Rosa damascena Mill. (Damask rose) is an aromatic, oil-bearing member of the Rosaceae family cultivated chiefly for its flowers. Hydrodistillation and solvent extraction produce four commercially important materials: essential oil, rose water (hydrosol), concrete, and absolute. Their uses overlap in fragrances and cosmetics, while rose water and other flower preparations also enter foods and traditional remedies (Aydinli & Tutaş, 2003; Kurkcuoglu & Baser, 2003; Mahboubi, 2016). Product composition is not fixed. Genotype, region, harvest, and processing alter both yield and chemical profile (Baydar & Baydar, 2005; Venkatesha et al., 2022). Among commercial oils from Bulgaria and Türkiye, Pellati et al. (2013) observed marked variation in citronellol, geraniol, and nonadecane and identified adulteration in several samples.

Medicinal interest in *R. damascena* arises from its longstanding use for gastrointestinal complaints, pain, and emotional distress (Akram et al., 2020; Mahboubi, 2016). Modern experiments have added reports of antioxidant, antibacterial, anti-inflammatory, analgesic, and neuropharmacological activity. That literature is fragmented across essential oils, hydrosols, and aqueous, hydroalcoholic, or solvent extracts, tested in systems ranging from cell-free assays to animal models (Akram et al., 2020; Boskabady et al., 2011a). How a result should be interpreted depends on both the product and the experimental model.

Human research has concentrated on aromatherapy, topical products, and oral preparations for pain, anxiety, sleep disturbance, and related symptoms. The record is mixed. A 2017 systematic review described preliminary benefit and called for confirmatory trials using standardized products (Nayebi et al., 2017). Five years later, a systematic review and meta-analysis restricted to oral and topical administration found no statistically significant reduction in acute pain and substantial heterogeneity (Koohpayeh et al., 2022). The contrast between these reviews makes preparation and route central to any clinical interpretation.

Against this background, the present review brings together the botany, phytochemistry, principal products, traditional uses, preclinical pharmacology, clinical research, and safety of *R. damascena*. The analysis follows each preparation from composition to route and evidence level, with particular attention to gaps between experimental activity and findings in people.

1.1. Botanical origin and historical context

Molecular analyses of four old Damask rose cultivars support a complex hybrid origin involving *Rosa moschata*, *Rosa gallica*, and *Rosa fedtschenkoana* (Iwata et al., 2000). The location and chronology of early cultivation are less certain. Botanical histories commonly link the oil rose to ancient Persia and trace its later movement into Europe and North Africa; western European collections contained Damask roses by the fourteenth century (Rusanov et al., 2009). Molecular evidence provides firmer support for hybrid ancestry than historical records provide for a precise place and date of origin.

1.2. Economic importance and production

Industrial cultivation of *R. damascena* eventually developed around specialized rose-oil production. Türkiye and Bulgaria remain long-established centers, with additional commercial production in Iran and India (Rusanov et al., 2009). Within Türkiye, Isparta and neighboring provinces form the main production region, where flowers are converted into rose oil, concrete, absolute, and rose water (Giray & Örmeci Kart, 2012).

Low essential-oil yield makes harvest and handling economically decisive. Delayed processing and prolonged pre-distillation fermentation reduce yield and alter the citronellol/geraniol ratio (Baydar & Baydar, 2005). In the 2011 Isparta value-chain analysis, harvesting accounted for 46.82% of variable production costs, while processed materials commanded much higher unit values than raw flowers (Giray & Örmeci Kart, 2012). The economic hierarchy of the products thus mirrors the importance of processing in their chemical identity.

1.3. Principal products and processing

Processing largely determines product identity. Hydrodistillation yields essential oil and an aqueous distillate collected as rose water, whereas solvent extraction produces concrete and, after ethanol treatment, absolute. Each pathway retains a different portion of the flower's volatile and nonvolatile chemistry (Ayci et al., 2005; Aydinli & Tutaş, 2003; Kurkcuoglu & Baser, 2003). Throughout this review, each biological finding is attributed to the material actually studied rather than to rose products as a group.

1.3.1. Rose essential oil

Commercial rose oil is obtained by hydrodistilling fresh flowers. Oil separated from the first distillate is combined with material recovered when the aqueous phase is redistilled (Ayci et al., 2005). Yields remain low and are sensitive to harvest timing and postharvest handling (Baydar & Baydar, 2005).

Flower-to-water ratio, operating time, temperature, equipment, raw-material quality, and production scale all influence hydrodistillation yield; this combination of variables explains why process reviews have not identified one optimal protocol (Katekar et al., 2022). Genotype adds further variation. An electronic-nose system separated *R. damascena* genotypes by patterns in major volatiles, serving as a rapid screen rather than a substitute for quantitative chromatographic authentication (Gorji-Chakespari et al., 2017). Reports that compare yield or activity are most informative when processing conditions and genotype appear together.

1.3.2. Rose concrete

Rose concrete is a pink-to-red, waxy semisolid obtained by extracting fresh blossoms with a nonpolar solvent, commonly n-hexane, n-pentane, or petroleum ether, followed by solvent removal under reduced pressure (Ayci et al., 2005). Concrete contains both volatile fragrance compounds and a substantial nonvolatile waxy fraction. It is an established commercial fragrance material and the intermediate from which rose absolute is produced.

1.3.3. Rose absolute

Rose absolute is obtained by extracting concrete with ethanol at low temperature, removing the insoluble waxy fraction, and evaporating the ethanol (Ayci et al., 2005; Aydinli & Tutaş, 2003). The resulting product is used principally in perfumery and cosmetics. Absolute is a principal commercial product, not a by-product of rose-oil distillation.

1.3.4. Rose water

Rose water is the aqueous distillate left after oil separation and is collected during essential-oil production (Ayci et al., 2005; Kurkcuoglu & Baser, 2003). Its chemistry reflects the greater water solubility of some aroma constituents rather than the composition of the separated oil. In volatile concentrates analyzed by Agarwal et al. (2005), 2-phenylethanol was predominant. Rose water is a distinct product in both chemical and commercial terms.

1.3.5. Dried flowers and experimental extracts

Fresh and dried petals are used in foods and traditional preparations, while aqueous, hydroalcoholic, methanolic, and other solvent extracts are prepared mainly for chemical or pharmacological investigation. Solvent and plant material determine which compounds enter an extract and need to be reported explicitly (Mahboubi, 2016). In this review, these preparations are identified by their extraction method rather than grouped with essential oil, rose water, concrete, or absolute. Table 1 summarizes the working distinctions.

Product	Production or source material	Defining characteristics	Interpretive distinction and key sources
Essential oil	Hydrodistillation of fresh flowers; oil from the first distillate is combined with oil recovered from redistillation of the aqueous phase.	Volatile fraction dominated by varying proportions of citronellol, geraniol, nerol, and long-chain hydrocarbons.	Low-yield commercial product. Composition varies with genotype, harvest, and processing; findings should not be transferred to hydrosol (Ayci et al., 2005; Baydar & Baydar, 2005; Pellati et al., 2013; Verma et al., 2011).
Concrete	Nonpolar-solvent extraction of fresh blossoms followed by solvent removal.	Waxy semisolid containing volatile fragrance compounds and a substantial nonvolatile fraction.	A major solvent-derived product and the precursor to absolute; it is not chemically equivalent to distilled essential oil (Ayci et al., 2005; Kurkcuoglu & Baser, 2003).
Absolute	Low-temperature ethanol extraction of concrete, removal of insoluble waxes, and evaporation of ethanol.	Concentrated fragrance material containing 2-phenylethanol, monoterpene alcohols, esters, and other volatiles.	A major commercial fragrance product refined from concrete, not a by-product of oil distillation (Aydinli & Tutaş, 2003; Ayci et al., 2005).

Product	Production or source material	Defining characteristics	Interpretive distinction and key sources
Rose water (hydrosol)	Aqueous distillate remaining after separation of the essential oil.	Contains water-soluble volatiles; 2-phenylethanol is frequently prominent in volatile concentrates.	By-product of essential-oil production. Its chemistry and biological activity cannot be inferred from the oil (Agarwal et al., 2005; Ayci et al., 2005; Kurkcuoglu & Baser, 2003; Verma et al., 2011).
Petals, distillation residues, and experimental extracts	Fresh or dried petals and solid residues extracted with water, hydroalcoholic mixtures, methanol, or other solvents.	Nonvolatile phenolics and flavonol glycosides, including quercetin- and kaempferol-derived compounds.	Plant part and solvent must be reported. Findings are preparation-specific and should not be generalized to commercial products (Kumar et al., 2006; Mahboubi, 2016; Schieber et al., 2005).

Table 1. *Principal R. damascena products, production methods, and interpretive distinctions*

Note. *Genotype, harvest conditions, processing, storage, and analytical method influence composition. The table treats each preparation as a separate evidence category because the products retain different chemical fractions.*

1.4. Chemical composition

No single chemical profile represents every *R. damascena* preparation. Essential oil and rose water are described mainly by their volatile fractions, whereas concrete, absolute, petals, and solvent extracts retain different proportions of volatile and nonvolatile constituents. Genotype, cultivation site, flowering stage, harvest, and processing further modify relative abundance (Baydar & Baydar, 2005; Pellati et al., 2013; Verma et al., 2011).

1.4.1. Essential oil and rose-water volatiles

Citronellol, geraniol, and nerol recur as major monoterpene alcohols in *R. damascena* essential oil, while nonadecane and heneicosane are prominent aliphatic hydrocarbons. Their proportions varied with cultivar, site, and flowering stage in oils from the North Indian hills (Verma et al., 2011). Commercial samples from Bulgaria and Türkiye were similarly variable, although citronellol, geraniol, and nonadecane remained major constituents (Pellati et al., 2013). Rose-water concentrates showed another pattern, dominated by 2-phenylethanol in separate analyses (Agarwal et al., 2005; Verma et al., 2011).
The finished oil also reflects precursor chemistry in intact petals. Oxygenated monoterpenoids, including (S)-3,7-dimethyl-5-octene-1,7-diol and related compounds, were characterized from *R. damascena* petals (Knapp et al., 1998), and Oka et al. (1998) identified a citronellyl disaccharide glycoside as an aroma precursor. Petal composition and distilled oil are therefore linked through enzymatic and thermal transformations rather than by simple one-to-one transfer.

1.4.2. Concrete and absolute

Chemical profiling of concrete and absolute highlights how solvent extraction differs from distillation. Once much of the insoluble wax has been removed with cold ethanol, the absolute retains 2-phenylethanol, citronellol, geraniol, nerol, eugenol, methyl eugenol, geranyl acetate, benzyl alcohol, nonadecane, 1-nonadecene, and farnesol; their relative abundances vary with processing temperature and ethanol concentration (Ayci et al., 2005; Aydinli & Tutaş, 2003). The separated waxy fraction consists largely of long-chain hydrocarbons and esters (Ayci et al., 2005). These compositional features distinguish concrete and absolute from both essential oil and rose water.

1.4.3. Nonvolatile compounds in petals and distillation residue

Distillation leaves nonvolatile flavonoids in the petals and solid residue. Schieber et al. (2005) identified 22 major flavonol glycosides derived from kaempferol and quercetin, including quercetin 3-O-galactoside and quercetin 3-O-xyloside, in distilled petals. Quercetin, kaempferol, their glycosides, and other flavonoids were also isolated from industrial flower residue (Kumar et al., 2006). These compounds characterize the nonvolatile petal fraction. Linking them to a biological outcome therefore requires the plant material and extraction procedure to be stated.

Earlier HPLC work characterized quercetin- and kaempferol-related flavonoids in *R. damascena* petals (Velioglu & Mazza, 1991). Later UPLC-QTOF profiling showed distinct phenolic fingerprints and antioxidant measurements among *R. damascena*, *Rosa bourboniana*, and *Rosa brunonii* (Kumar et al., 2009). A broader review of rose-flower chemistry reached the same general conclusion: species, tissue, and extraction method determine the fraction detected (Mileva et al., 2021). In the present synthesis, cross-species comparisons provide chemical context, while species-specific conclusions draw only on *R. damascena* data.

1.5. Traditional uses

Traditional medicinal records concern mainly flower-derived preparations. Persian and other medical texts describe their use for abdominal and chest pain, digestive complaints, constipation, menstrual bleeding, and as a cardiac tonic (Akram et al., 2020; Mahboubi, 2016). Their value here is historical: they identify longstanding uses and research questions rather than establishing modern efficacy or safety.

A recurring difficulty is that traditional terminology rarely identifies the preparation with modern pharmacological precision. Petal remedies, rose water, and products called rose oil may contain very different volatile and nonvolatile fractions. Interpretation becomes more reliable when both material and route are recoverable from the source. Human intervention studies are therefore considered separately from traditional-use reports (Akram et al., 2020; Mahboubi, 2016).

1.6. Routes of administration and product-specific interpretation

R. damascena preparations have been given orally, applied topically, and inhaled, but route alone says little about the intervention. Across studies, the delivered material ranged from essential oil and rose water to flower extracts and petal products (Akram et al., 2020; Nayebi et al., 2017). Meaningful comparison requires the plant material, extraction or manufacturing method, dose or concentration, comparator, and model to be reported together.

The same information defines the limits of interpretation. A solvent extract tested in vitro answers a different question from inhaled essential oil, just as an animal response differs from a patient outcome. The following sections keep preclinical and human evidence separate and organize conclusions around the preparation and route actually studied (Nayebi et al., 2017).

2. Literature Search and Evidence Framework

The evidence base was assembled through targeted literature searches, citation tracking, reference-list screening, and verification of journal and publisher records. To update the clinical and safety evidence, PubMed was searched on July 31, 2026, for records published from January 2024 through July 31, 2026. The update combined "*Rosa damascena*," "*Rosa* × *damascena*," or "Damask rose" with terms for clinical trials, randomized studies, systematic reviews, safety, adverse effects, pharmacology, aromatherapy, pain, anxiety, sleep, women's health, gastrointestinal outcomes, dermatology, and antimicrobial activity. Earlier literature was identified from the established source set and backward citation tracking. Peer-reviewed clinical, in vivo, and in vitro studies were eligible when the tested material was identified as *R. damascene,* and the preparation and experimental model could be determined. Books and monographs supplied botanical, historical, production, or safety context. Studies of other Rosa species were excluded from the evidence synthesis; multicomponent interventions were retained but interpreted as formulations rather than evidence for rose alone. This was a critical narrative review rather than a systematic review; no protocol was registered, and study selection was not intended to support an exhaustive effect estimate. Records were grouped first by product and route and then by experimental level and outcome. For human research, interpretation considered the comparator, sample size, intervention duration, outcome measurement, blinding constraints, and adverse-event reporting. Systematic reviews and meta-analyses were used to assess consistency, while conclusions remained anchored in the characteristics of the underlying trials. This framework prevents mechanistic assays, animal models, and patient outcomes from being treated as equivalent forms of evidence. Figure 1 summarizes the approach.

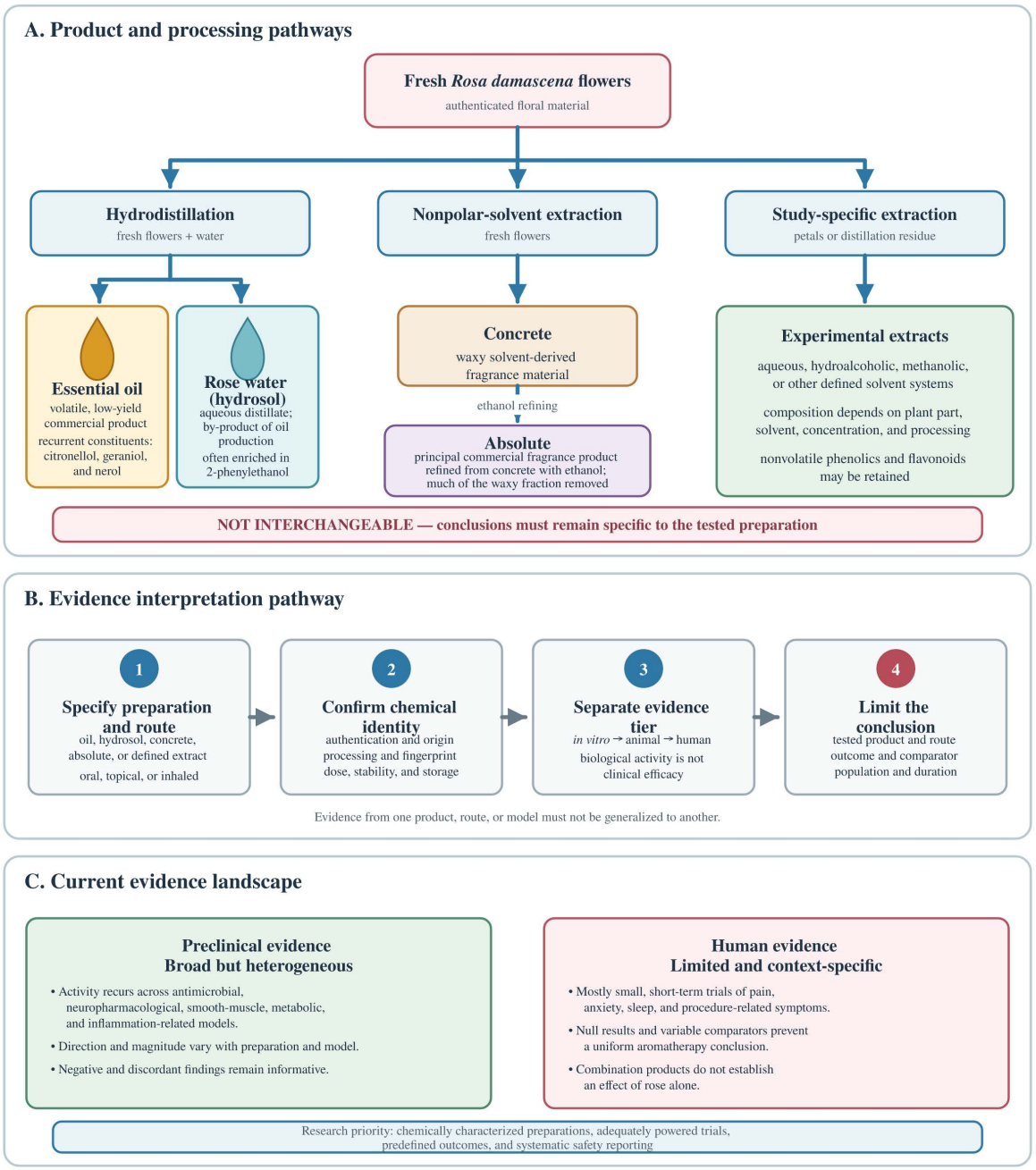

Figure 1. *Product-specific preparation pathways and evidence interpretation for R. damascene*

Note. *Original figure created for this review. Product identity reflects genotype, harvest, processing, storage, and analytical method. The arrows show how preparation and evidence level set the appropriate scope of interpretation.*

3. Preclinical Pharmacological Evidence

Most pharmacological research on *R. damascena* remains in vitro or animal-based. The subsections below describe the tested preparation and model alongside the reported outcome. This distinction matters because *R. damascena* is marketed in chemically distinct forms, including essential oil, hydrosol, solvent-derived fragrance products, and experimental extracts.

3.1. Antimicrobial activity

In vitro antimicrobial findings vary with product, chemical profile, target organism, and assay. Gochev et al. (2008) compared rose oils from Bulgaria, Türkiye, Morocco, Iran, and China against three Gram-positive bacteria, three Gram-negative bacteria, and two yeasts under the same test conditions. Bulgarian oil showed the highest overall activity; *Bacillus cereus* was the most susceptible organism (minimum cidal concentration, 128 µg/mL), whereas *Pseudomonas*

aeruginosa and *Pseudomonas fluorescens* were less susceptible (4096 µg/mL). The authors linked these differences partly to variation in oxygenated monoterpenes, including citronellol, geraniol, and nerol.

An earlier comparative screen included *R. damascena* among several essential oils and related antimicrobial responses to gas-chromatographic composition (Andoğan et al., 2002). Read alongside the geographic comparison by Gochev et al. (2008), it reinforces a laboratory signal linked to oil composition. The two studies are less informative about therapeutic performance because neither evaluated a standardized clinical rose product.

Direct comparisons among preparations are particularly informative. Ulusoy et al. (2009) observed strong antibacterial activity against six bacterial strains with *R. damascena* absolute and essential oil, whereas the hydrosol did not show comparable activity. In a separate assay, rose essential oil inhibited *Cutibacterium acnes* (reported as *Propionibacterium acnes* in the original study), with an inhibition zone of 16.5 ± 0.7 mm and a minimum inhibitory concentration of 0.031% (v/v) (Zu et al., 2010).

Target organism adds another source of variation. *R. damascena* essential oil inhibited three strains of the plant pathogen *Xanthomonas axonopodis pv. vesicatoria* in vitro (Basim & Basim, 2003). Because the organism is a plant pathogen, the experiment extends the assay range rather than the evidence for treating human infection. Across the antimicrobial literature, activity recurs under defined laboratory conditions, although differences in oil composition, solubilization, inoculum, and susceptibility method make direct comparison difficult.

3.2. Antioxidant activity

Antioxidant activity has been reported mainly in cell-free chemical assays of flower or petal extracts. Özkan et al. (2004) compared fresh flowers with spent flowers remaining after distillation. Both extracts retained antiradical activity at 100 ppm, and their values were similar, although the fresh-flower extract had higher total phenolic content and a higher antioxidant-capacity measure. The similar activity observed after distillation shows that the residue remained chemically active.

Assay choice substantially affected the apparent potency. A hydroalcoholic petal extract produced an IC50 of 2.24 µg/mL in a DPPH radical-scavenging assay but 520 µg/mL in a lipid-peroxidation assay (Yassa et al., 2009). Bioassay-guided fractionation identified quercetin and kaempferol glycosides. The complete extract nevertheless outperformed kaempferol 3-O-rhamnoside in the DPPH assay, indicating that no single isolated flavonoid accounted for the observed activity.

Achuthan et al. (2003) extended the antioxidant work beyond cell-free assays by isolating an acetone fraction from fresh-flower juice and administering it orally at 50 mg/kg in rats with carbon tetrachloride-induced liver injury. Serum enzyme activities and lipid-peroxide levels fell relative to the untreated injury group. Because both the exposure and injury model were highly specific, the results apply most directly to that fraction rather than to rose water, essential oil, or whole petals. The remaining whole-organism experiments are difficult to place on a common scale. Essential oils from *R. damascena* and *Lavandula angustifolia* were examined in a mouse model of L-dopa-associated oxidative toxicity (Nikolova et al., 2016), whereas a rose-flower extract was associated with altered mortality in adult *Drosophila* (Jafari et al., 2008). Given the different species, exposures, and endpoints, these are better read as separate exploratory observations than as a unified antioxidant narrative.

3.3. Analgesic and anti-inflammatory activity

A hydroalcoholic flower extract and the essential oil were evaluated across animal models of nociception and inflammation. Responses varied with preparation, dose, and endpoint, although biological activity appeared under selected conditions (Hajhashemi et al., 2010). No preparation emerged as a consistent lead for translation, leaving the clinically relevant product and route unresolved.

That distinction becomes important in the clinical literature: migraine, burn-dressing pain, labor pain, and pooled acute-pain analyses involve different exposures and outcomes. Animal nociception and inflammation models provide biological context for those trials, not confirmation of their results.

3.4. Cytotoxicity in cancer cell models

One formulation study loaded *R. damascena* essential oil into nanostructured lipid carriers (RDEO-NLC2) and tested the formulation in MDA-MB-231 human breast-cancer cells. RDEO-NLC2 reduced cell viability and increased apoptosis relative to placebo nanoparticles and free essential oil, while cisplatin remained more cytotoxic (Yari et al., 2024). Within this single cell line, the response was therefore formulation-dependent.
A separate study exposed SW742 human colon-cancer cells and fibroblasts to fractions derived from *R. damascena* essential oil and reported different cytotoxic responses (Rezaie-Tavirani et al., 2013). Together, the two studies identify

cellular effects worth mechanistic follow-up, but they do not form a coherent anticancer evidence base: the cell lines, fractions, and formulation strategies differ, and neither study includes in vivo exposure or pharmacokinetic confirmation.

3.5. Antidiabetic activity

Only one study directly connected an *R. damascena* extract with glucose regulation. A methanol flower extract inhibited α-glucosidase noncompetitively, and oral doses of 100–1000 mg/kg reduced the post-maltose rise in blood glucose in normal and diabetic rats (Gholamhoseinian et al., 2009). The enzyme and rat responses align mechanistically, but no human dose or commercial preparation was evaluated.

3.6. Anticonvulsant activity

Seizure studies used different *R. damascena* preparations and experimental designs. In mice challenged with pentylenetetrazole (PTZ), intraperitoneal aqueous extract at 100–1000 mg/kg delayed both minimal clonic and generalized tonic-clonic seizures. Ethanolic extract changed only selected endpoints at 500 or 1000 mg/kg, and the chloroform extract was inactive; mortality was unchanged (Hosseini et al., 2011). In Wistar rats, essential oil at 500–1000 mg/kg altered PTZ-seizure latency and severity (Kheirabadi et al., 2008). Doses of 750 and 1000 mg/kg also delayed acquisition of electrically induced amygdala kindling and changed selected behavioral and electrophysiological measures (Ramezani et al., 2008). The variation across preparations is as prominent as the anticonvulsant signal itself.

Homayoun et al. (2015) added a seven-day pretreatment design in rats using a 70% ethanolic flower extract at 50–200 mg/kg intraperitoneally. Seizure latency increased and epileptiform-burst frequency fell at every dose; burst amplitude decreased at 100 and 200 mg/kg, while burst duration was unchanged. Fewer dark neurons were observed in the examined hippocampal regions. Across the available models, delayed or attenuated seizure expression recurs more consistently than effects on mortality or a defined molecular mechanism. Flavonoid involvement and GABAA signaling remain hypotheses, and the absence of clinical trials leaves therapeutic relevance unresolved.

3.7. In vitro anti-HIV activity

A single 1996 study examined the anti-HIV activity of *R. damascena* water and methanol extracts and nine compounds isolated from the methanol fraction (Mahmood et al., 1996). Both extracts showed moderate activity. Among the isolated compounds, kaempferol reduced maturation of infectious progeny virus in a pattern consistent with selective HIV-protease inhibition. Quercetin and two 3-substituted kaempferol derivatives interfered with viral gp120 binding to CD4. The phenylethanol glycoside *2-phenylethanol O-(6-O-galloyl)-β-D-glucopyranoside* interacted irreversibly with gp120 and neutralized viral infectivity. The authors attributed the apparent synergy between kaempferol and this glycoside to their different modes of action.

Chemically, the study concerns isolated nonvolatile constituents rather than rose essential oil. Translationally, it is a cell-based lead-identification experiment conducted before contemporary antiretroviral regimens and current screening standards. No later *R. damascena* pharmacokinetic or clinical anti-HIV investigation was found. Its present value lies in the molecular leads it identified, not in treatment guidance.

3.8. Sedative and sleep-related effects

Sedative or hypnotic research has relied mainly on pentobarbital-potentiation models. In mice, intraperitoneal aqueous and ethanolic extracts at 500 and 1000 mg/kg prolonged barbiturate-induced sleep, whereas the chloroform extract was inactive (Rakhshandah & Hosseini, 2006). A second fractionation study found the largest response with the ethyl acetate fraction at 500 mg/kg and the smallest with the water fraction (Rakhshandah et al., 2007). The common endpoint was prolonged drug-induced sleeping time, and the active constituents were not identified.
Pentobarbital potentiation may reflect direct central nervous system depression, altered drug action, or altered disposition and therefore offers a limited model of normal sleep. GABAA involvement was not tested directly. The human aromatherapy studies discussed below use another preparation and route and address a different clinical question.

3.9. Respiratory effects

Respiratory research separates into two lines: suppression of experimentally induced cough and relaxation of isolated airway smooth muscle. In guinea pigs, aerosolized ethanolic extract at 5 and 10% (w/v) and aqueous extract at 20% reduced citric acid-induced cough, whereas the 10% aqueous preparation was inactive. Active treatments did not differ statistically from codeine at the concentrations tested (Shafei et al., 2003). The inactive and active aqueous concentrations make the dose dependence clear, but the signal remains confined to this guinea-pig model.

Airway-tissue studies add a mechanistic layer. Ethanolic extract and essential oil relaxed guinea-pig tracheal chains under KCl- and methacholine-based conditions. The response disappeared after combined propranolol and chlorpheniramine incubation, leading to a hypothesis involving β-adrenoceptors and/or histamine H1 receptors (Boskabady et al., 2006). Fractionation then showed the most consistent relaxation with the ethyl acetate fraction, while aqueous and n-butanol fractions were weaker and sensitive to the contractile stimulus (Rakhshandah et al., 2010). Thus, response tracks both fraction chemistry and experimental context; the tissue studies do not yield a human dose.

More recent work with *R. damascena* essential oil in isolated rat tracheal rings showed concentration-dependent relaxation of acetylcholine- and KCl-induced contraction. Pharmacological inhibition suggested involvement of voltage-gated, ATP-sensitive, and large-conductance calcium-activated potassium channels (Demirel, 2022). Conducted in another species and under a different protocol, the experiment introduces a possible mechanism rather than confirming the earlier receptor proposal. Clinical studies in asthma, chronic obstructive pulmonary disease, or human cough are absent.

3.10. Cardiovascular effects

Cardiovascular findings are internally diverse. In Langendorff-perfused guinea-pig hearts, an aqueous-ethanolic flower extract (0.1–1.0 mg%) increased heart rate and contractility (Boskabady et al., 2011b). A follow-up experiment from the same group reproduced these acute responses under propranolol-, methacholine-, and diltiazem-based conditions and proposed β-adrenoceptor stimulation as a contributor (Boskabady et al., 2013). Both studies describe acute myocardial stimulation in isolated hearts; whether that response has relevance to cardiac disease remains unknown.

Whole-animal findings point in another physiological direction. In anesthetized normotensive rats, intraperitoneal hydroalcoholic extract at 250, 500, and 1000 mg/kg lowered systolic blood pressure without a significant change in heart rate (Shafei et al., 2015). Vascular and autonomic influences present in an intact circulation may explain the contrast with the isolated-heart response. The rat experiment was acute, intraperitoneal, and conducted in normotensive animals, leaving oral antihypertensive efficacy unresolved.

At the molecular level, five flavonoids from *R. damascena* buds were tested against HMG-CoA reductase and angiotensin I-converting enzyme (ACE). Roxyloside A, isoquercitrin, afzelin, and quercetin gentiobioside inhibited HMG-CoA reductase (IC50 47.1–80.6 μM). Cyanidin-3-O-β-glucoside was inactive against that enzyme but inhibited ACE (IC50 138.8 μM); the other four compounds did not inhibit ACE (Kwon et al., 2010). The selectivity between compounds is more informative than a species-wide “cardioprotective” label. These were nonvolatile bud constituents, and no lipid- or blood-pressure outcome was measured in vivo.

A 45-day hyperlipidemic-rabbit experiment supplies an important negative comparison. Methanolic *R. damascena* flower extract produced moderate but statistically nonsignificant changes in plasma lipids and atherosclerotic plaque measures, whereas *Quercus infectoria* produced significant effects (Gholamhoseinian et al., 2012). This negative animal result tempers the enzyme-based hypothesis of lipid lowering.

3.11. Gastrointestinal effects

Preclinical gastrointestinal work distinguishes laxative activity from intestinal propulsion. In rats, an orally administered boiled extract of *R. damascena* increased fecal number and water content and promoted fluid accumulation in ligated jejunal segments, similarly to lactulose. Gastrointestinal transit of phenol red was unchanged (Arezoomandan et al., 2011). Increased stool water without faster transit is consistent with an osmotic component.

Isolated-tissue findings move in opposite directions according to the preparation. An aqueous fraction from an ethanolic extract mildly increased basal contraction of guinea-pig ileum at 0.66–1.3 mg/mL (Dolati et al., 2013). Flower essential oil, by contrast, inhibited KCl- and electrical field stimulation-induced contractions in isolated rat ileum; geraniol and citronellol were more potent than the complete oil in that system (Sadraei et al., 2013). The results are not contradictory; they show distinct, context-dependent responses to an aqueous fraction and a volatile oil.

A separate experiment addressed intestinal inflammation. In rats with acetic acid-induced colitis, oral hydroalcoholic extract at 250–1000 mg/kg and intraperitoneal extract at 125–500 mg/kg reduced macroscopic, histological, and myeloperoxidase indices. Among oral volatile-oil doses, 100 μL/kg was active across the reported indices (Latifi et al., 2015). Treatment began before colitis induction and continued for four days, making this an acute, partly prophylactic model. The human constipation studies discussed below concern multicomponent formulations and answer a different question.

Across preclinical domains, the pattern is uneven, not uniformly positive. Antimicrobial, neurobehavioral, smooth-muscle, and inflammation-related activity recurs across more than one experimental system, whereas the anti-HIV, cytotoxic, and antidiabetic narratives rest on one or two model families. Product identity explains part of this variation:

nonvolatile extracts dominate enzyme, antioxidant, seizure, and colitis studies, while essential oil appears more often in antimicrobial and smooth-muscle experiments. Negative or discordant findings are equally informative, including inactive chloroform fractions, unchanged PTZ-associated mortality, absent acceleration of intestinal transit, and nonsignificant lipid outcomes. Standardization and independent replication would now add more value than another undifferentiated activity screen.

4. Clinical Evidence

4.1. Pain, anxiety, and sleep-related outcomes

Migraine data are mainly negative. In a double-blind crossover trial of 40 adults, topical *R. damascena* oil produced no overall advantage over placebo for pain intensity, nausea or vomiting, photophobia, or phonophobia (Niazi et al., 2017). Lower pain scores appeared only at selected time points within an exploratory traditional-syndrome subgroup. The prespecified overall comparison, rather than the post hoc subgroup, provides the more reliable estimate.

Burn-dressing trials reported a more consistent short-term pattern. Inhalation of 40% Damask rose essence was associated with lower post-dressing pain in 50 patients (Bikmoradi et al., 2016). Among 132 patients, rose aroma, Benson relaxation, and their combination reduced pain anxiety, with the combination often producing the largest change (Daneshpajooh et al., 2019). A separate trial of 120 patients found immediate reductions in pain and state anxiety after rose inhalation, but later analgesic use and trait anxiety were unchanged (Sadeghi et al., 2020). Across the three studies, benefit was confined to the dressing period. Recognizable odor also made complete blinding difficult, and neither wound healing nor sustained analgesia was evaluated.

Meta-analytic conclusions depend heavily on which routes, populations, and outcomes are included. Nasiri et al. (2021) pooled 16 randomized studies of Damask rose aromatherapy and found lower acute pain but rated the evidence as low quality because methods and results varied widely. Koohpayeh et al. (2022), using a later review limited to topical and oral preparations, found no statistically significant benefit and again observed substantial heterogeneity. A 2025 meta-analysis of 28 randomized trials reported pooled improvements in anxiety, stress, and sleep after *R. damascena* aromatherapy, but effects on depressive symptoms were minimal, and the estimates remained highly context-dependent (Xu et al., 2025). The differing pooled results reflect eligibility rules, products, comparators, and outcome selection; they do not support a uniform effect across indications.

Cardiac-procedure studies do not tell a single story. Inhalation of 40% *R. damascena* was associated with lower pre-angiography stress and anxiety in 98 patients (Bikmoradi et al., 2022). By contrast, 4% rose essential oil produced no change in state, trait, or total anxiety before coronary artery bypass grafting in 66 patients (Fazlollahpour-Rokni et al., 2019). A larger open-heart-surgery study reported postoperative differences after rose or lavender aromatherapy (Babatabar Darzi et al., 2020). Brief exposure, subjective outcomes, and recognizable aromas complicate comparison across these settings. The positive signal summarized by Rasooli et al. (2021) has therefore not appeared consistently in individual cardiac populations.

Sleep is the clinical outcome with the most frequently favorable reports, although study quality remains variable. Randomized trials in cardiac-care patients recorded better sleep scores after rose aromatherapy (Hajibagheri et al., 2014; Jodaki et al., 2021), and a small cancer study found improvement in selected measures (Heydarirad et al., 2019). Following coronary artery bypass surgery, rose and lavender changed only selected domains and neither oil was superior (Emami-Sigaroudi et al., 2021). A pediatric before-and-after study lacked a concurrent control (Keyhanmehr et al., 2018). A systematic review and meta-analysis reported a pooled sleep-quality effect, but most included trials were rated only fair, and some reported adverse events (Ghorbani Rami et al., 2021). The pooled estimate therefore rests on varied instruments, comparators, and clinical settings.

4.2. Women's health and perinatal applications

Perinatal trials have focused on immediate symptom relief. After cesarean delivery, inhaled Damask rose or lavender reduced short-term pain and state anxiety relative to saline, with no clear anxiety difference between the two oils (Abbasijahromi et al., 2020). During labor, repeated rose inhalation was associated with lower pain and anxiety scores than saline (Hamdamian et al., 2018). Another study combined rose aromatherapy with a warm foot bath, so the contribution of aroma could not be separated (Kheirkhah et al., 2014). The trials were designed around immediate symptoms; obstetric outcomes and replacement of standard analgesia were not examined.

The remaining women's-health studies address distinct outcomes and should not be pooled as one therapeutic signal. In a triple-blind trial of 82 menopausal women, hydroalcoholic *R. damascena* extract capsules produced larger reductions in Menopause Rating Scale scores over eight weeks than placebo (Gholinezhad et al., 2025a). Related reports from the same research program described improvements in sexual-function measures and in depression, anxiety, and stress scores

after oral extract capsules (Gholinezhad et al., 2025b, 2025c). Because the publications appear to involve closely related recruitment settings and interventions, they should not automatically be counted as independent replications. A 2024 randomized trial also evaluated rose aromatherapy for postpartum depressive symptoms and sleep quality, extending the evidence to another population but retaining the limitations of odor-based blinding and short follow-up (Hosseini et al., 2024). A separate aromatherapy trial in 95 students compared *R. damascena*, *Citrus aurantium*, and sweet-almond oil; psychological symptoms changed in both active groups, with a clearer within-group change in selected physical and social outcomes in the rose arm (Heydari et al., 2019). Oral extracts and inhaled preparations involve different exposures and symptom constructs, so their findings remain indication- and product-specific.

In preterm infants, a four-group trial compared the odors of breast milk, *Lavandula stoechas*, *R. damascena*, and a sham condition during venipuncture (25 infants per group). Pain scores were lower in all three odor groups than in the sham group; breast milk produced the largest reduction, while rose and lavender did not differ. SpO_2 was also higher with rose and lavender than with sham (Askarinia et al., 2024). Rose was thus one of several odors associated with lower pain during a single brief procedure. Whether the effect is reproducible in neonatal care remains unknown.

Pregnancy-related nausea has been examined in one small crossover pilot. Forty primigravid women at 7–14 weeks received rose-oil inhalation plus placebo drops or placebo-oil inhalation plus metoclopramide for five days, then crossed to the alternate intervention. Rhodes Index scores fell during the initial periods, but between-treatment differences were not significant, and sleep scores did not change (Afiat et al., 2024). The small sample and absence of maternal, fetal, and longer-term safety outcomes leave the comparison inconclusive. In a pilot of this size, a null between-treatment difference may reflect inadequate power rather than similar efficacy.

4.3. Gastrointestinal combination interventions

Constipation trials evaluated formulations rather than isolated *R. damascena*. In 100 children older than 12 months, a syrup prepared from decocted petals and brown sugar was compared with polyethylene glycol for four weeks (Imanieh et al., 2022). Both groups improved, with cure rates of 100% and 91.7%, respectively, and no significant between-group difference. Because the ingredients were administered together, the outcome describes the syrup as a whole.

The second trial compared a *Foeniculum vulgare–R. damascena* formula with polyethylene glycol 4000 in older adults (Azimi et al., 2022). Twenty-five participants in each group completed treatment. Constipation severity, stool consistency, and quality of life improved, and several outcomes favored the herbal formula. A later double-blind trial evaluated a *Melissa officinalis–Pimpinella anisum–R. damascena* formula in constipation-predominant irritable bowel syndrome and reported improvement in anxiety and depression relative to placebo (Azimi et al., 2024). That study concerns a three-herb intervention and psychological outcomes in IBS-C, not isolated rose or constipation efficacy alone. Together, these trials make multicomponent products clinically interesting but leave the contribution of *R. damascena*, optimal dose, comparative effectiveness, and durability unresolved.

4.4. Dermatological and cosmetic evidence

Dermatological research spans flower extracts, hydrosol, essential oil, fermented preparations, and formulated products, but the endpoints vary just as widely. Antioxidant or antimicrobial activity addresses a different question from hydration, wrinkle reduction, pigment correction, or treatment of a skin disorder (Chroho et al., 2022). Evidence on rosehip from *Rosa canina* is not included here because it does not concern *R. damascena* petals or oil.

Diluted *R. damascena* hydrosol inhibited *Candida albicans* mycelial growth at approximately 2.2%, reduced methicillin-resistant *Staphylococcus aureus* viability within 1 h, and suppressed stimulus-induced neutrophil adhesion responses at 5–15% in vitro (Maruyama et al., 2017). A small human experiment provided a useful translational counterpoint: among 45 volunteers, rose-hydrosol hand rubbing did not reduce skin-flora colony counts, whereas an alcohol-based antiseptic did (Bayhan et al., 2020). The contrast between selected in vitro effects and the volunteer study illustrates how readily performance can change between an assay and a use setting.

The acne evidence is less direct. One laboratory study tested two multicomponent botanical mixtures against *Cutibacterium acnes* and examined inflammatory and steroid-metabolism-related gene expression in HaCaT keratinocytes; *R. damascena* flowers were only one ingredient (Kılıç et al., 2019). Because neither the effects of individual ingredients nor clinical endpoints such as lesion counts, sebum, comedones, or acne severity were measured, the contribution of *R. damascena* remains unknown.

A self-emulsifying topical system containing *R. damascena* extract was evaluated in a 20-patient psoriasis pilot after comparative phytochemical and formulation work across three *Rosa* species. Erythema, induration, scaling, and quality-of-life measures improved (Gavra et al., 2022). With only 20 participants and a complex delivery system, however, the

pilot was not designed to separate the contribution of the extract from that of the formulation or to establish the performance of unformulated rose products.

The photoaging study provides a more coherent preclinical sequence. In UVB-exposed human dermal fibroblasts, *R. damascena* extract reduced matrix metalloproteinase-related collagen degradation and modulated AP-1 and TGF-β/Smad signaling. Dietary administration in UVB-irradiated hairless mice was associated with fewer wrinkles and higher collagen-related measures (Park et al., 2017). These findings concern an orally administered extract in preclinical photoaging models; topical anti-aging efficacy in people has not been tested.

Safety varies with product composition and concentration. A cosmetic ingredient assessment considered the evaluated *R. damascena*-derived ingredients acceptable under reported conditions of use only when formulated to be non-sensitizing. The panel identified benzyl alcohol, eugenol, methyl eugenol, geraniol, citronellol, limonene, linalool, and farnesol as constituents of concern and emphasized good manufacturing practices to limit impurities, including pesticide residues and heavy metals (Expert Panel for Cosmetic Ingredient Safety, 2022). Patch-test reactions to rose oil were also documented. The assessment applies to cosmetic ingredients under specified use conditions and does not establish the safety of oral, medicinal, or undiluted use. Overall, dermatological research is strongest at the mechanistic and formulation stages; controlled human evidence for acne, inflammatory dermatoses, pigmentation, moisturization, and anti-aging remains sparse. A cross-domain synthesis of the human evidence is provided in Table 2.

Clinical domain and preparation	**Evidence pattern**	**Principal limitations**	**Key sources**
Pain and anxiety — topical oil or inhaled essence	The overall migraine comparison was null. Burn-dressing and selected procedural studies reported short-term reductions, whereas cardiac-procedure anxiety findings were inconsistent. Reviews indicate a possible signal but not a uniform effect across routes.	Recognizable odor complicates blinding; preparations, comparators, and eligibility criteria vary. Outcomes are brief and self-reported, with no evidence of long-term analgesia or disease modification.	Bikmoradi et al., 2016, 2022; Fazlollahpour-Rokni et al., 2019; Nasiri et al., 2021; Niazi et al., 2017; Rasooli et al., 2021; Sadeghi et al., 2020
Sleep — primarily inhaled essential oil	Small trials and recent meta-analytic evidence report improvement in selected sleep and anxiety outcomes after inhaled preparations.	Populations, instruments, comparators, and odor-based blinding differ. Pooled effects are heterogeneous, and depressive-symptom effects were minimal in the newest meta-analysis.	Emami-Sigaroudi et al., 2021; Ghorbani Rami et al., 2021; Hajibagheri et al., 2014; Jodaki et al., 2021; Xu et al., 2025
Women's and perinatal outcomes — inhalation or oral hydroalcoholic extract	Short-term trials report changes in selected perinatal, menopausal, sexual-function, and psychological outcomes after inhalation or oral extract capsules.	Evidence remains indication- and formulation-specific. Related menopausal publications may represent overlapping cohorts; odor-based blinding and long-term maternal, fetal, neonatal, and oral safety remain limited.	Afiat et al., 2024; Askarinia et al., 2024; Gholinezhad et al., 2025a, 2025b, 2025c; Hamdamian et al., 2018; Hosseini et al., 2024
Functional constipation — oral multicomponent preparations	Rose-containing multicomponent preparations improved selected constipation or IBS-C-related outcomes in short randomized trials.	The contribution of *R. damascena* cannot be isolated from brown sugar, *Foeniculum vulgare*, *Melissa officinalis*, or *Pimpinella anisum*.	Azimi et al., 2022, 2024; Imanieh et al., 2022
Dermatological and cosmetic outcomes — hydrosol or formulated extract	Rose hydrosol did not reduce hand-flora counts. A 20-patient formulation pilot reported improvement in psoriasis signs. Acne evidence derives from a multibotanical laboratory	Chemically distinct preparations, a negative translational result, small preliminary clinical evidence, and absence of controlled acne or anti-aging trials preclude general efficacy claims.	Bayhan et al., 2020; Gavra et al., 2022; Kılıç et al., 2019; Park et al., 2017

Clinical domain and preparation	Evidence pattern	Principal limitations	Key sources
	mixture, and anti-aging findings remain preclinical.		

Table 2. *Critical synthesis of human evidence for R. damascena preparations*

Note. *The table summarizes evidence patterns rather than implying equivalence across products. Essential oil, hydrosol, solvent extracts, and multicomponent formulations are chemically and clinically distinct.*

5. Safety, Tolerability and Interaction Considerations

Adverse events were usually secondary outcomes and were observed over short periods. Most human studies enrolled too few participants to detect uncommon reactions, and several used a single inhalation or only a few treatment days. Trials included in the sleep meta-analysis reported headache, nausea, vomiting, and frequent sneezing (Ghorbani Rami et al., 2021). Excessive sweetness limited acceptance of the pediatric constipation syrup, while mild diarrhea occurred with the fennel–rose formula (Azimi et al., 2022; Imanieh et al., 2022). Available studies describe tolerability during brief, supervised exposure far better than during chronic or unsupervised use.

Risk assessment begins with product identity. Concentrated essential oil differs from hydrosol and dilute extracts in exposure, oxidation, and sensitization potential. Safety guidance, cosmetic assessment, and a recent systematic review identify composition, concentration, route, impurities, and fragrance sensitizers as relevant variables (Expert Panel for Cosmetic Ingredient Safety, 2022; Lalovski et al., 2025; Tisserand & Young, 2013). The recent review also emphasized substantial heterogeneity in preparations, dosages, and study designs, which prevents a single safety conclusion from being transferred across products. Pharmacokinetic interactions and chronic oral use remain poorly characterized. The same is true for pregnancy, breastfeeding, neonatal exposure, seizure disorders, and concomitant use with sedatives, antiseizure drugs, anticoagulants, or other medicines. Current safety information should therefore be interpreted only for the preparation, dose, route, formulation, and duration examined.

6. Conclısions and Research Priorities

A single therapeutic profile is not an accurate summary of the *R. damascena* literature. Essential oil, hydrosol, concrete, absolute, nonvolatile extracts, isolated compounds, oral formulations, and multibotanical products represent separate chemical and experimental streams. Laboratory activity is most developed in antimicrobial, antioxidant, neuropharmacological, smooth-muscle, metabolic, and inflammation-related models, but its direction and magnitude change with preparation and context.

The clinical record is smaller and less consistent than the preclinical literature. Several trials and a recent meta-analysis report short-term changes in anxiety, stress, sleep, or selected women's-health outcomes, yet null migraine, depressive-symptom, and cardiac-anxiety findings rule out a uniform aromatherapy effect. Constipation and IBS-C findings belong to combination products. Related menopausal reports may not represent independent replications, and the dermatological signal rests on a small formulation pilot. The central message remains the distance between broad experimental activity and limited, product-specific clinical replication.

The next phase of research should begin with the product, not merely the species name. Authenticated plant material, plant part, origin, manufacturing conditions, chemical fingerprint, marker ranges, dose, route, and stability should define each preparation before efficacy is tested. Mechanistic work will be more useful when controls and endpoints have clear biological relevance. Clinical studies, in turn, require prospective registration, adequate power, credible comparators, predefined primary outcomes, systematic adverse-event monitoring, and follow-up long enough to match the intended use. Fewer well-characterized preparations would advance the field more than another broad activity screen.

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Declaration Of Ethical Code

The authors declare that all rules required under the Higher Education Institutions Scientific Research and Publication Ethics Directive were followed and that none of the actions listed under "Actions Contrary to Scientific Research and Publication Ethics" were undertaken.

As this article is a narrative review based exclusively on previously published literature and did not involve human participants, animals, or the collection of primary data, ethics committee approval was not required.

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