

**PHYTOCHEMICAL AND PHARMACOLOGICAL IMPORTANCE OF MALVA NEGLECTA: AN
UPDATED REVIEW**

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Abstract

Traditional herbal medicine is known to mankind from decades and still widely practiced throughout the globe. Plants employed in traditional applications are the potential sources of cheap herbal medicines. *Malva neglecta* from family *Malvaceae* is used to treat several serious ailments. Numerous phytoconstituents identified in different parts of *Malva neglecta* exhibit strong therapeutic effects. Phytochemical studies on this plant have revealed the presence of phenolic acids, flavonoids, lipids and anthocyanins. *Malva neglecta* showed a wide range of pharmacological activities including antioxidant, anti-arthritic, anti-microbial, anti-urolithiatic, anti-cholinesterase, anti aging and few others. This review article summarizes all the essential information on the phytochemical and pharmacological importance of *Malva neglecta* and will be a valuable addition to the pharmacology of plants as there is no previously reported review present on this topic.

Keywords: *Traditional medicine, Malva neglecta, Phytochemicals, Pharmacological activities.*

Introduction

Bioactive compounds from natural sources are gaining consumer attention owing to increased cost and potentially damaging side effects of conventional medicines. Plant-based medicines are promising for drug development because they are significant sources of phytochemical constituents. These constituents obtained from traditional plants are the potential raw material for the production of new medicines. By the mid of 19th century, the origin of almost 80% of the medicines was herbs. It is generally recognized that folk medical uses of plants specify the existence of biologically active constituents in a plant. In a broader sense, traditional medicines represent a shortcut method to discover contemporary medicines [1, 2]. Herbal medicines have also been known as botanical medicines or phytomedicines. The medicinal properties of the traditional plants are attributed to their parts like stem, roots, bark, fruit, flowers and leaves to support general health and treatment. Such herbal constituents may be utilized as a formulation or may be incorporated into different products [3].

Malva neglecta is an annual herbaceous plant of the genus *Malva* and family *Malvaceae* traditionally eaten fresh as a leafy vegetable or used as decoctions. It is also used to treat several medical conditions such as abdominal pain, asthma, colds, digestive and urinary tract infections [4]. Scientific studies have reported antioxidant, antibacterial and anti-ulcerogenic properties for this plant [5].

Plant profile

Taxonomic classification

Kingdom: Plantae; **Subkingdom:** Tracheobionta; **Superdivision:** Spermatophyta; **Division:** Magnoliophyta; **Class:** Magnoliopsida; **Subclass:** Dilleniidae; **Order:** Malvales; **Family:** Malvaceae; **Genus:** *Malva* L.; **Species:** *Malva neglecta* Wallr. [6].

Common names and distribution

It is known by various common names such as Common mallow, dwarf mallow, cheese plant, cheese weed, button weed and round leaf mallow [7]. *Malva neglecta* is locally known as Sonchal [8], and Banerak [9] in Pakistan. In Turkey, it is called as ebeğümeci, develik, gömeç, kömeç, ebeğümeci and

tolik by local people in Turkey [10]. Its local name Hmamchoorieh and Panirak in Iran [11, 12].

Genus *Malva* is comprised of 25–30 species of annual, biennial, and perennial plants. The genus is prevalent throughout the temperate, subtropical and tropical regions of Europe, Asia and Africa [13, 14]. *Malva neglecta* is native to almost all of Europe, from northern Europe (e.g., Denmark, Ireland, Norway, Sweden, United Kingdom), middle Europe (e.g., Austria, Belgium), Southeastern Europe (e.g., Albania, Bulgaria, Croatia, etc.), to Southwestern Europe (e.g., France, Portugal, Spain). It is also found in Western Asia, the Arabian Peninsula, Northwestern Asia (e.g., Armenia, Kazakhstan, Uzbekistan, Mongolia) and also in China and the Indian subcontinent. In Africa, it is found mostly in North Africa, Such as Algeria and Morocco [15].

Morphological characteristics

The leaves are stipulate, shallowly lobed, long-stalked crenate, pilose and blade-kidney shaped. Its flowers are actinomorphic, 1.5-2.5 cm wide. Petals are of 8-15mm and white, pinkish or red-veined with notched tips [16]. Sepals are triangular and 2-4.5mm in size. Mericarps are smooth and epicalyx is linear. Flowers are borne in leaf axils. Stem is erect and pilose with simple setae [17].

Traditional uses

Malva neglecta had been used as herbal medicine in the treatment of different diseases in Iran. All parts of the plant exhibit diuretic, demulcent, laxative and anti-phlogistic properties. The leaves and flowers have been used mainly as a poultice, for inflammation, bruise and insect bites or internally for respiratory and urinary tract infections [18]. The stem and root of this plant is abortifacient and aerial parts have been used to treat hemorrhoids, kidney stones and diarrhea. The leaf bears the therapeutic potential against stomachache, gynecological disorders, cough and diabetes. Its poultice has been used widely for maturation of abscess and wound healing [10]. The plant is used for the treatment of acne, burns, broken bones, dermatitis and throat infection [19].

Malva tea helps to lessen inflammation and mouth irritation due to its high mucilage content. *Malva neglecta* is a valuable plant to treat cough because of its expectorant and cough-suppressing action. Additionally, leaves of

this plant contain tannins, which alleviate stomachache and diminish intestinal spasms [7].

Phytochemical investigation

The methanol extracts of *Malva neglecta* have been screened by using a liquid chromatography-mass spectrometry (LCMS) to qualify and quantify different compounds including several phenolic acids, flavonoids and some non-phenolic compounds shown in Table 1. *Malva neglecta* was rich in terms of phenolic acids [20]. Regarding the amount of total phenolics in *Malva neglecta*, leaf contained the highest concentration, which directly coincides with high antioxidant capacity of the plant [21]. Among the phenolics, the largest contribution was from flavonoids. Flavonoids made up the largest group by the contribution of both subgroups: flavonols and anthocyanins. Very low levels of anthocyanin is present in the different parts of *Malva neglecta* [10]. Malvidin was the main flavonoid compound of *Malva* cells followed by catechin, delphinidin, and apigenin [22]. 4-Hydroxycinnamic acids made the second largest group of phenolic compounds contributing approximately 10–18% of total phenolics. The distribution pattern of total phenolics total flavonoids and 4-hydroxycinnamic acids was same in the parts of plant i.e. root < stem < fruit < flower < leaf [10].

The composition of the lipids obtained from the petroleum ether extract has been identified as palmitic acid (36.8%), linoleic acid (17.8%), and linolenic acid (13.2%). The chief constituents of the essential oil have been identified as cineole (18.8%), hexatriacontane (7.8%), tetratetracontane (7.8%) and α -selinene (4.2%). When compared the essential oil composition of *Malvaceae* family, *M. neglecta* is seemed to have richer content than others [20]. *Malva neglecta* has considerable amounts of 4-hydroxy benzoic, salicylic acids and malic acid content [10].

Pharmacological activities

Anti-oxidant activity

Excess generation of reactive oxygen species (ROS) and other free radicals (O_2^-), (HO^\cdot), H_2O_2 , (1O_2) during metabolism results in oxidative stress which is related to inflammation, cancer, ageing and various chronic diseases responsible for increase in death rate. Exogenous antioxidants namely Vitamin E, carotenoids and flavonoids

prevent oxidative stress and delay the oxidative processes [23]. Natural antioxidant compounds, derived from plant sources, have been identified as active oxygen scavengers [24]. Nowadays, interest has been increased considerably in the discovery of natural antioxidants for use in medicine to replace the synthetic antioxidants, which are being restricted due to their harmful effects [25].

Hydroalcoholic extract of *Malva neglecta* have shown strong antioxidant capacity, hydrogen peroxide scavenging, free radical scavenging, superoxide anion radical scavenging, and metal chelating activities in comparison with natural and synthetic standard antioxidants such as BHA, BHT and α -tocopherol [26]. Phenolic compounds and flavonoids have also been reported to show potent *in vitro* antioxidant properties and their potential in the prevention of various diseases caused by oxidative stress [27]. Anti-oxidant capacities of *M. neglecta* fruit have been measured using Folin-Ciocalteu method, ferric reducing assay and oxygen radical absorbance capacity assays [10], which are based on mechanisms of electron transfer and quantify the total concentration of redox-active species [28].

Anti-inflammatory activity

Malva neglecta extract reduces the production of pro-inflammatory cytokines in synoviocytes. It reduces TNF- α gene expression in both LPS-induced human monocytic cell lines (THP-1 cells) and synoviocytes. Moreover, it can reduce IL-1 β , COX-2, IL-18 and iNOS genes expression in synoviocyte cells. This shows that the *Malva neglecta* is effective in the reduction of pain and inflammation in osteoarthritis [11].

TNF- α is the main inflammation causing agent among the inflammatory cytokines involved in the pathogenesis of osteoarthritis. Previous anti-inflammatory studies performed on medicinal plants have shown that the consumption of these plants reduces the expression of inflammatory cytokines TNF- α , IL-1 β , PGE₂ and induced NO [18]. The reduction in expression of TNF- α and IL-1 β cytokines by *Malva* extract, that slows down the process of cartilage weakening and reduction in the production of prostaglandin and nitric oxide is reported in the pain relief and inflammation [30]. *Malva's* potential to reduce the pro-inflammatory factors has been studied in various tissue cell types, and its role as an

alternative and supplement method to traditional NSAIDs used in the treatment of osteoarthritis was confirmed [31].

The reduction in expression or production of inflammatory agents has been found to be less with ibuprofen and betamethasone as compare to *Malva neglecta* extract. This extract has been reported to be effective in preventing and treating other diseases associated with inflammation and tissue damage [28]. Anti-inflammatory effect of *Malva neglecta* extract may be due to saponin content present in this plant [32].

Anti-microbial activity

Various researches have been documented on the anti-microbial properties of *Malva neglecta* extracts. Previous studies have demonstrated bactericidal [33], antifungal [13], and immunomodulatory [34] properties of this plant. Suitable efficacy of chloroform, water and ethanol extracts on some bacterial and fungal contaminants have been confirmed [35]. All extracts of this plant were active against *S. aureus*, *P. aeruginosa*, and *P. vulgaris* which have been reported to be troublesome bacteria in wound infections, especially in the case of antibiotic resistant microorganisms. Anthocyanin can be responsible for acceptable antibacterial effects of aqueous extracts of this plant [36].

The anti-bacterial activity has been quantitatively determined by the presence of inhibition zone around the discs containing the extract. *Malva neglecta* can depress *S. aureus* and *S. epidermidis* bacterial growth and this anti-bacterial paralleled to increasing of concentration. The highest activity was against *S. epidermidis*. These strains were more susceptible to the extract of *Malva neglecta* as compared to standard antibiotics [37]. Organic extracts have been found to yield more consistent results regarding antimicrobial activity. A report by Parekh et al. [38], illustrated that most of the identified antimicrobial phytochemicals were water insoluble, a possible reason why extracts by organic solvents were more effective. *Malva neglecta* organic solvent extract was more effective against the growth of bacterial strains mentioned in Table 3. A study reported by Jasim (2006), reported that the petroleum ether extract inhibited the growth of *S. aureus*, *S. pneumoniae*, *H. influenzae* and *M. catarrhalis* [16].

The crude extracts of *Malva neglecta* have shown to be effective against fungal strains. Chloroform and Ethyl acetate fractions were active in fungal strains mentioned in table 3. The water and *n*-butanol fractions of plant extract have the best Antifungal activity [36]. The reason behind the anti-bacterial and anti-fungal activity might be the presence of certain phytochemicals such as alkaloids, glucosinolates, flavonoids, rhamnose, tannins, phenolic acids and volatile oils [19].

Anti-cholinesterase activity

Inhibition of acetylcholinesterase is a promising treatment strategy in case of neurological disorders such as myasthenia gravis; senile dementia, glaucoma, Parkinson's disease and ataxia [39]. Polyphenols are biologically active compounds embedded in plant parts and are known to prevent degenerative diseases [40]. All of the extracts of *Malva neglecta* exhibit moderate activity against acetyl- and butyryl-cholinesterase enzymes. Especially, the *Malva neglecta* methanolic extract have the highest activity against acetyl- and butyryl-cholinesterase enzymes. There are only few studies about *Malva* and *Malvella* genus anticholinesterase activity in literature. Therefore, *Malva neglecta* may be useful as good anticholinesterase inhibitor. However, further evaluations, particularly in vivo tests, are needed to understand the activity in biological systems [20].

In addition to that there are two studies about anticholinesterase activity of *Thespesia populnea* (*Malvaceae*). In these researches, it has been reported that *T. populnea* bark is important for improving memory and in the management of Alzheimer disease [41].

Anti-urolithiac activity

Malva neglecta is extensively used in folk medicine for urolithiasis. This plant had a preventive and treatment effect on calcium oxalate (CaOx) calculus formation and tubulointerstitial damage with a dosage dependent manner. Administration of ethylene glycol and ammonium chloride can induce renal CaOx deposition in rats [42, 43] as a model to mimic the kidney stone formation in humans. There has been a traditional use of *Malva neglecta* in kidney stones, and it has been evaluated by its aqueous extracts on ethylene glycol and ammonium chloride induced kidney stones in male rats. Microscopic examinations of kidney sections have

shown extensive renal damage and CaOx deposits in calculi induced rats. In prophylactic and curative treatment groups, low and high dosages of extract reduced the number of CaOx calculi and tubulointerstitial damage whereas high dosages of extract seemed to be more effective. The exact mechanisms involved in the effect of *M. neglecta* on CaOx calculi remain unclear.

It has been speculated that *Malva neglecta* prevents the formation of CaOx calculi and tubulointerstitial damage due to its antioxidant and anti-inflammatory effects. Saponins have been reported to exhibit antioxidant, antiviral and cholesterol lowering properties [31]. Previous studies have indicated that plants rich in saponin content have protective effects on the renal oxidative stress and renal interstitial fibrosis in rat models [42]. They play a vital role in prevention of ethylene glycol induced urolithiasis [44].

In traditional medicine, *Malva neglecta* is used for the treatment kidney stones and urinary disorders. The anti-urolithiatic activity of this plant might be attributed to its components such as saponins, flavonoids, mucilage, and phenolic compounds [45].

Anti-ageing

Traditional art describes use of *Malva neglecta* in forms such as a water decoction, after removing insoluble parts of the plant taken orally, as a poultice, or an infusion applied to wounds and tumors. *Malva neglecta* in the form of decoctions have been used for treating abscesses, boils, burns, eczema, and insect bites Using water typically extract only the most polar constituents, e.g., tannins [15].

(Rogers et al., 1996) demonstrated significant decreased levels of major skin lipid species, in particular ceramides with increasing age. (Jensen et al., 2005) demonstrated reduced activities of ceramide-generating enzymes in the inner epidermis of aged Skin. It is highly desirable to increase skin lipid levels, e.g., ceramide levels, to achieve significant improvements in skin barrier structure and function specifically improving on the appearance of aging [46, 47].

Extracts of *Malva neglecta* provide a significant increase in ceramide levels in human skin cells, which is indicative of improved skin barrier function. Certain extracts of *Malva neglecta* are

beneficial for use in topical compositions for application to the skin and provide significant and unexpected benefits for skin, include enhancing skin barrier protection and skin moisturization, improving, reducing, inhibiting, or delaying the appearance of aging in skin [15].

Conclusion

To conclude, *Malva neglecta* is a widely distributed plant with significant pharmacological effects. The presence of phytochemicals in all parts of the plant makes it highly beneficial to be used in various diseases. However, these wide range of phytoconstituents need to be explored more.

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Table 1: List of some reported chemical compounds in *Malva neglecta*.

Sr. No.	Compound	Chemical type
1.	Gallic acid	Phenolic acid
2.	Chlorogenic acid	Phenolic acid
3.	Protocatechuic acid	Phenolic acid
4.	Tannic acid	Phenolic acid
5.	tr- caffeic acid	Phenolic acid
6.	p-Coumaric acid	Phenolic acid
7.	Rosmarinic acid	Phenolic acid
8.	Rutin	Flavonoid
9.	Hesperidin	Flavonoid
10.	Salicylic acid	Phenolic acid
11.	Myricetin	Flavonoid
12.	Fisetin	Flavonoid
13.	Chrysin	Flavonoid
14.	Rhamnetin	Flavonoid
15.	Apigenin	Flavonoid
16.	Kaempferol	Flavonoid
17.	Luteolin	Flavonoid
18.	Hesperetin	Flavonoid
19.	Naringenin	Flavonoid
20.	Quercetin	Flavonoid
21.	Lauric acid	Lipid
22.	10-Undecenoic acid	Lipid
23.	Myristic acid	Lipid
24.	Palmitic acid	Lipid
25.	Phytol	Alcohol
26.	Linoleic acid	Lipid
27.	Oleic acid	Lipid
28.	Stearic acid	Lipid
29.	Arachidic acid	Lipid
30.	6-Hexadecenoic acid	Lipid
31.	Behenic acid	Lipid

Table 2: Summary of effective extracts and plant parts of *Malva neglecta* for specific pharmacological activity.

Pharmacological activity	Effective extract	Plant parts	References
Anti-oxidant	Hydroalcoholic extract	Flowers and leaves	[26]
Anti-inflammatory/ anti arthritic	Aqueous extract	Whole plant	[29]
Anti-microbial/anti-bacterial	Ethanollic extract	Aerial parts	[18]
Anti-cholinesterase	Methanolic extract	Aerial parts	[20]
Anti-urolithiac	Aqueous extract	Leaves	[28]
Anti-hypertensive	N/A	Whole plant	[9]
Anti-tussive	N/A	Seed, flower, fruit	[11,12]

N/A= Not available

Table 3: Bacterial and fungal strains active against *Malva neglecta* [19].

Bacterial Strains	Fungal Strains
<i>Escherichia coli</i>	<i>Aspergillus fumigatus</i>
<i>Klebsiella pneumonia</i>	<i>Aspergillus flavus</i>
<i>Salmonella typhi</i>	<i>Aspergillus niger</i>
<i>Bacillus subtilis</i>	<i>Fusarium solani</i>

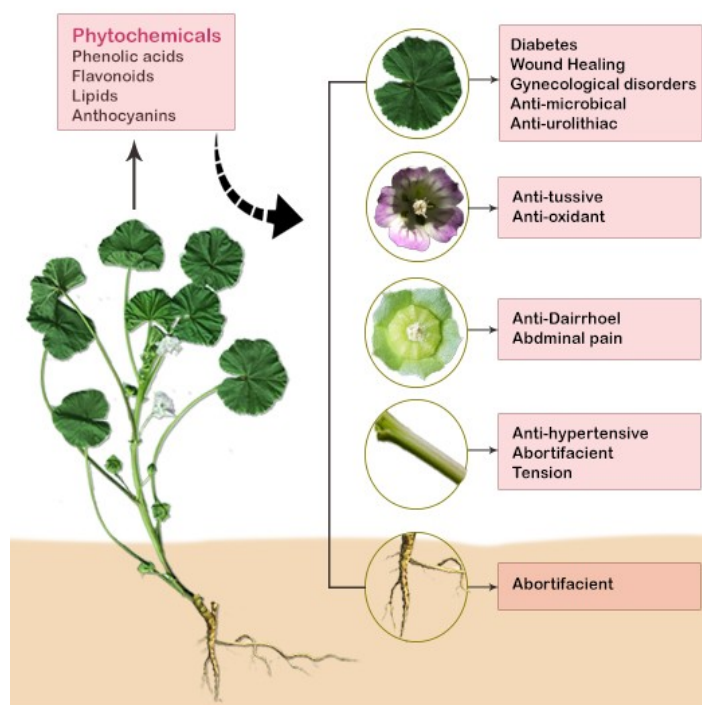


Figure 1: *Malva neglecta* (plant parts, phytochemicals and respective traditional uses).