



CALENDULA – A REVIEW

Harsh Vardhan , B.pharma
LNCT UNIVERSITY, KOLAR ROAD
BHOPAL ,MP

ABSTRACT

Calendula Officinalis, commonly known as marigold, is a plant that has been used in traditional medicine for centuries. It is known for its powerful medicinal properties, and has been used to treat various health conditions like skin irritations, inflammation, and digestive disorders. In recent years, scientists have conducted extensive research on this plant and have discovered its numerous health benefits. In this blog post, we will delve into the phytoconstituents of Calendula Officinalis and explore how they contribute to its health benefits. We will also discuss the various ways in which this herb can be used to promote health and wellbeing, and how you can incorporate it into your daily routine. So, let's get started and discover the power of Calendula Officinalis. Calendula officinalis is used to treat various diseases like skin injuries , burn on skin , also used as anti-inflammatory , anti-diabetic , anti-tumor , it's extract is still used as antiviral , used progressively in ulcers , and sooth irritated issue , also as anti-genotoxic.

Keywords: Calendula officinalis, anti-ulcer, antiviral, anti-genotoxic anti-inflammatory, hepato-protective, spasmolytic properties

INTRODUCTION

Calendula officinalis, also known as pot marigold, is a flowering plant that belongs to the Asteraceae family. This plant is native to the Mediterranean region, but it is now commonly grown in many parts of the world. Calendula officinalis has been used for centuries for its medicinal properties and has been an integral part of traditional medicine in many cultures.

The plant has bright orange or yellow flowers that are rich in flavonoids, carotenoids, and essential oils. These phytoconstituents are the active compounds that give Calendula officinalis its unique properties and benefits. The leaves and petals of the plant are commonly used in herbal remedies, teas, tinctures, and topical preparations.

Calendula officinalis has a long history of use in treating a variety of ailments, including skin irritations, cuts, bruises, and burns. It is also known for its anti-inflammatory, anti-bacterial, and anti-fungal properties^[1]. In addition, Calendula officinalis has been shown to have antioxidant effects that help protect the body against free radical damage.

With its many health benefits and versatile uses, Calendula officinalis is a valuable plant that continues to be used in modern medicine and natural health remedies^[2]. Calendula officinalis plant has a rich history in traditional medicine. It has been used for centuries in various cultures around the world for its medicinal

properties. Ancient Greeks, Romans, and Egyptians used *Calendula* to treat wounds, soothe skin irritations, and alleviate fevers. The plant was also used in Ayurvedic medicine to treat various ailments, including stomach ulcers, menstrual cramps, and toothaches. In traditional Chinese medicine, *Calendula* was used to improve blood circulation and treat digestive disorders. Native Americans used it to treat a range of conditions, including sore throats and eye infections. The plant's popularity in traditional medicine can be attributed to its anti-inflammatory, antimicrobial, and antioxidant properties. Today, *Calendula Officinalis* is still used in herbal medicine to treat a range of conditions, including skin irritations, digestive disorders, and menstrual cramps. Its healing properties have been extensively studied, and research continues to uncover new potential health benefits^[3]. The medicinal properties of *Calendula* are attributed to its high content of flavonoids, saponins, and triterpenoids. These phyto-chemicals have anti-inflammatory, antimicrobial, and antioxidant properties, making *Calendula* a popular ingredient in many skincare products. The use of *Calendula* in modern medicine has also been studied extensively, with promising results in the treatment of various conditions such as eczema, psoriasis, and wound healing^[4].

In summary, the long history of *Calendula Officinalis* in traditional medicine is a testament to its effectiveness as a healing plant. Its numerous phyto-chemicals have been shown to have significant health benefits and are being used in modern medicine to treat a variety of conditions. With its long-standing reputation as a potent medicinal plant, it's no wonder that *Calendula* remains a popular ingredient in many natural remedies and



Figure 1 . *Calendula officinalis* (pot marigold) flower , leaves and seeds

Table .1 : calendula officinali different vernacular names^[4]

Language	Vernacular names
English	Pot marigold , English marigold , holligold, marybud , gold-bloom
Hindi	Genda
Punjabi	Gulsarfi
Urdu	Gul-e-asharfi
Marathi	Bhande jhendu
Sanskrit	sthalpadmam

Table 2 : Taxanomic classification of calendula officinalis^[5]

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Asterales
Family	Asteraceae
Tribe	Calenduleae
Genus	Calendula
Species	c. officinalis

Cultivation and harvest of Calendula Officinalis

Calendula officinalis, commonly known as marigold, is a versatile, easy-to-grow herb that can thrive in a variety of growing conditions. To grow calendula officinalis, it is important to provide the plant with ideal soil and exposure. Marigolds prefer well-drained soil and full sun exposure, but they can also tolerate partial shade. Additionally, marigolds emit a substance that repels insects, making them an ideal plant to set up in the vegetable garden. With proper care and cultivation, calendula officinalis can produce beautiful orange-yellow flowers that have many medicinal benefits .

Harvesting calendula officinalis is a simple process that can be done manually or mechanically. The plant forms a bushy clump that is slightly erect and spreading, making it ideal for borders, beds, rock gardens or pots. The flowers can be harvested by hand, or a mechanical harvester can be used for larger scale operations . It is best to harvest the flowers in the morning when the dew has dried, as this is when the flowers have the highest concentration of medicinal properties . After harvest, the flowers can be dried and stored for later use^[6].

To preserve and store calendula officinalis, it is important to dry the flowers well before storing them in an airtight container. The flowers can be dried by hanging them upside down in a cool, dark place with good ventilation. Once the flowers are completely dry, they can be stored in airtight containers, such as glass jars or plastic bags, in a cool, dry place. Properly dried and stored calendula officinalis can retain its medicinal properties for up to a year . Techniques for preparing calendula officinalis extract include gentle disintegration in soybean oil or propylene glycol and butylene glycol extractions .

Description

Cultural Conditions: Light

- Full sun (6 or more hours of direct sunlight a day)
- Partial Shade (Direct sunlight only part of the day, 2-6 hours)

Soil Texture:

- Clay
- High Organic Matter
- Loam (Silt)
- Sand

Soil pH:

- Acid (<6.0)
- Alkaline (>8.0)
- Neutral (6.0-8.0)

Soil Drainage:

- Good Drainage
- Moist

NC Region:

- Coastal
- Mountains
- Piedmont

Morphological characters^[7-11]

Leaves:

Leaf Color:

- Green

Leaf Value To Gardener:

- Fragrant

Leaf Type:

- Simple

Leaf Shape:

- Lanceolate
- Oblong
- Obovate

Leaf Margin:

- Dentate

Leaf Length:

- 3-6 inches

Leaf Description:

- Aromatic, lance-shaped to oblong-obovate green leaves (to 6" long).

Stem:**Stem Is Aromatic:**

- No

Stem Form:

- Straight

Stem Description:

- sparsely branched lax or erect stems

Fruit:**Display/Harvest Time:**

- Fall

Fruit Type:

- Achene

Fruit Description:

- Seeds ripe from August to November.

Flowers:**Flower Color:**

- Gold/Yellow
- Orange
- Red/Burgundy

Flower Inflorescence:

- Head

Flower Value To Gardener:

- Edible
- Good Cut
- Showy

Flower Bloom Time:

- Spring
- Summer

Flower Size:

- 3-6 inches

Flower Description:

Single to double flowerheads (3-4" diameter) may have contrasting darker center disks. Deadhead spent flowers to promote additional bloom.

Chemical composition of Calendula Officinalis

Calendula Officinalis, also known as marigold, is a plant that has been used for its medicinal properties for centuries. It belongs to the Asteraceae family and is native to Mediterranean countries, although it has now spread to other parts of the world. The plant is rich in various phyto-chemicals that contribute to its medicinal properties.

The chemical composition of Calendula Officinalis includes carotenoids, flavonoids, triterpene saponins, essential oils, and polysaccharides. Carotenoids are antioxidant pigments that give the plant its yellow or orange color. Flavonoids are plant metabolites that have antioxidant and anti-inflammatory properties. Triterpene saponins are compounds that have been found to have anti-inflammatory, antifungal, and antimicrobial properties. Essential oils are volatile compounds that are responsible for the plant's aroma and have antifungal and antibacterial properties. Polysaccharides are complex sugars that have been found to have immunomodulatory properties.

These phyto-chemicals work together to provide Calendula Officinalis with its many health benefits. The plant

has been found to have anti-inflammatory, antifungal, and antimicrobial properties, making it useful in the treatment of various skin conditions such as eczema, acne, and dermatitis. It has also been found to promote wound healing and reduce pain and swelling. Additionally, *Calendula Officinalis* has been found to have immunomodulatory properties, which means it can help boost the immune system and protect against infections. Overall, the chemical composition of *Calendula Officinalis* is what makes it such a powerful and versatile medicinal plant.

Various phyto-chemical studies have revealed the presence of different chemical compounds including carbohydrates, amino acids, lipids, carotenoids, terpenoids, flavonoids, volatile oil, quinines, coumarins and other constituents.

Terpenoids

Terpenoids are a class of organic compounds that can be found in many plants, including the calendula plant. They are responsible for the plant's distinct aroma and taste. Terpenoids have been shown to have a range of therapeutic properties, including anti-inflammatory, analgesic, and antibacterial effects. They work by interacting with our body's endocannabinoid system and other receptors in our body, which can trigger a cascade of biological effects^[12].

Calendula oil is rich in terpenoids, which is why it is often used in aromatherapy and natural medicine. When applied topically, calendula oil can help soothe skin irritations and reduce inflammation. It can also help promote wound healing and relieve pain. Some studies have even suggested that terpenoids found in calendula oil may have anti-cancer effects, although more research is needed in this area.

Overall, terpenoids are a fascinating class of compounds that have many potential therapeutic benefits. If you are interested in natural remedies and aromatherapy, calendula oil may be a great addition to your toolkit.

There are many terpenoids which is being reported after doing petroleum ether extract of *C. officinalis* flowers. Some of the terpenoids which is being reported are as follows ;

- Sitosterol , lupeol , stigmasterol , erythrodiol , 3-monoesters of taraxasterol , ursadiol , arnidiol-3-o-laurate , calenduladiol-3-o-opalmitate , calenduloseAH etc^[13-17].

Flavonoids

Some of the flavonoids have been detected when ethanol extract was performed of inflorescence of *c.officinalis*. They are as follows;

- Quercetin , calendoflavobioside , isorhamnetin , rutin , calendoflaside , quercetin-3-o-rutinoside^[18-20].

Coumarins

When the ethanol extract of the inflorescence of the *c.officinalis* was performed then it was reported that it contains coumarins – scopoletin , esculetin^[21].

Quinones

Major of the quinones found from extracts of *c.officinalis* leaves are ;

- Plastoquinone , phylloquinone , chloroplast , ubiquinone , phylloquinone^[22].

Volatile oil

The flower of *c. officinalis* contains volatile oil but at different stages of flowering it has different amount of volatile oil like it has maximum volatile oil at full flowering stage about 0.97% and minimum at pre-flowering stage 0.32%. The volatile oil contain numerous of monoterpenes and sesquiterpenes ;

- α -thujene , sabinene , β -pinenene , limonene , 1,8-cineol , 3-cyclohexane-1-ol , α -phelandrene , α -lubene , α -ylangene , α -humulene , α -cadinene , β -aryophyllene , germacrene , 1,4-diene , nerolidol , palustron , tmuurolo[²³].

Carotenoids

On performing the extraction of leaves , petals and pollens of *c. officinalis* by using ethanol as solvent we got to get various carotenoids .

- 9Z-neoxanthin , neoxanthin , luteoxanthin , flavoxanthin , lutein , β -cryptoxanthin , β -carotene . These carotenoids are found in petals and pollens . Whereas 9Z-violaxanthin , antheraxanthin , mutatoxanthin epimer 1 , mutatoxanthin epimer 2 , these carotenoids are found in leaves and stem^[24,25] .

Carbohydrates

Presence of polysaccharides have been reported when ethanolic extra of the inflorescences of plant was done^[26].

Amino Acids

Flower ethanolic extract of the plant *c. officinalis* showed that there are 15 amino acids are present in *c. officinalis* they are as follows;

- Alanine , arginine , lysine , threonine , methionine , leucine , tyrosine , valine , histidine.
- 5% , 3.5% , and 4.5% amino acids content was detected in leaves , stem and flowers^[27].

Lipids and Fatty Acids

The petroleum ether extract of the seeds , leaves and flowers of *c. officinalis* has shown presence of lipids into the plant.

Presence of lipid in seeds was 15.77% , phospholipids 0.6% and glycolipids 0.97%.^[28]

Many of fatty acids are also present in *c. officinalis* they are as follows Lauric , stearic , linoleic and linolenic acid^[29].

Table 3. major phytochemicals from different parts of plant calendula.

plant parts	groups	active ingredients	references
Flower	Terpinoids	Lupeol, taraxasterol	30
		Erythrodiol	31
		Calenduloside	32
		Calendulaglycoside A,calendulaglycoside B	33
	Flavonoids	Cornulaic acid acetate	34
		Isoquercitrin ,rutin , calendoflavoside.	33
		Querecetin , isorhamnetin. Isorhamnetin-3-o-β-D glycoside , Narcissin.	35 36
	Coumarins	Esculetin , scopoletin , umbelliferone .	37
	Volatile oils	Cunenol, α-cadinol, oplopanone , methyllnoleate.	38
		Sabinene , limonene , α- pinene , p-cymene , nonanal , carvacrol , geraniol , nerolidol , palustron.	39
Leaves	Quinones	Phylloquinone , α- tocopherol , ubiquinone , plastoquinone.	40
Root	Terpenoid	Calenduloside B	41

PHARMACOLOGICAL ACTIVITIES

Pharmacological studies have confirmed that *C.officinalis* exhibit a broad range of biological effects, some of which are very interesting for possible future development.

Calming effects on anxiety and stress

Calendula oil has been used for centuries as a natural remedy for various ailments, including anxiety and stress. The oil contains a group of compounds known as terpenoids, which have been found to have therapeutic effects on the mind and body.

Shrinivasan BD et. al.,^[42] have studies and found that terpenoids can help reduce feelings of anxiety and stress by interacting with the receptors in the brain responsible for regulating mood and emotions. Calendula oil, in particular, has been found to have a calming effect on the mind and body, making it an ideal natural remedy for those suffering from anxiety-related disorders.

In addition to its calming effects, calendula oil also has anti-inflammatory properties, making it a great natural remedy for those suffering from conditions like arthritis, eczema, and psoriasis. Its anti-inflammatory properties also make it a potent natural remedy for reducing pain and inflammation in the body.

Overall, calendula oil is a powerful natural remedy that can be used to treat a wide range of ailments, including anxiety and stress. Its therapeutic effects on the mind and body make it an ideal natural alternative to traditional medicine for those looking to improve their overall health and wellbeing .

Anti-oxidant activities

Banarase NB et.al.,^[43] found in his study that aqueous extract of the *c. officinalis* petals has promising antioxidant activity.

Gastrointestinal effects

Wagner H et. al.,^[44] demonstrated the antiulcerous action of *calendula officinalis* plant in his study he got to know that the chemical constituent calendulozideB-trioside extracted from the rhizomes of *calendula officinalis* is effective in ulcer for this he took three doses of the above constituents 5,10,20&50mg/kg in 3 experimental ulcer models and found that it has antiulcerous activity, another experiment was done on 162 patients by Chakurski I et. al.,^[45] who have duodenal ulcers gastroduodentitis & they are treated with a herbal combination which contains *calendula* and the result was such that 90% of the symptoms got vanished.

Age – defying

Calendula oil has been used for medicinal purposes for centuries, especially in skin care. This oil is extracted from the marigold flower, and it contains powerful antioxidant and anti-inflammatory properties. *Calendula* oil is known for its skin healing properties and is often used in various skin care products such as lotions, balms, and creams. Lohani A et al.,^[46] have found that the oil is effective in treating a wide range of skin conditions, including acne, eczema, and psoriasis. It has a soothing effect on the skin, reducing inflammation and promoting the growth of new skin cells. *Calendula* oil also has antibacterial and antifungal properties, which makes it effective in preventing infections.

In addition to its healing properties, *calendula* oil is also an excellent moisturizer. It helps to hydrate the skin, keeping it soft and supple. The oil is easily absorbed into the skin and does not leave a greasy residue, making it perfect for those with oily skin.

Overall, *calendula* oil is a powerful natural remedy for various skin conditions. Its antioxidant, anti-inflammatory, antibacterial, antifungal, and moisturizing properties make it an excellent ingredient in skin care products. Incorporating *calendula* oil into your daily skin care routine can help keep your skin healthy, radiant, and youthful-looking.

Photoprotective

Fonesca YM et .al.,^[47] has found that the formulations which carry *c. officinalis* in it's constituents has promising effect on skin damage by UVB-radiation.

Insecticidal activity

Alexenizor M et al^[48], have done an experiment in which he took the flower extract in acetone, methanol solvent (the solvent was in ratio 2:1v/v) and the flower extract was proved to have insecticidal activity.

Wound healing activity

Chandran PK et.al.,^[49] performed an experiment in which experimentally induced thermal burned rats were taken and they are treated with ethanolic extract of the *c. officinalis* flowers. The extract doses (20,100 and 200mg/kg of body weight) were taken in which the extract dose of 200mg/kg showed promising result in healing wounds as indicated by increase in collagen-hydroxyproline and hexosamine contents.

Episiotomy

Episiotomy is a surgical incision of the perineum and the posterior vaginal wall generally done by a midwife or obstetrician. Episiotomy is usually performed during second stage of labor to quickly enlarge the opening for the baby to pass through. A randomized trial was done by Carlo De Angelis et.al.,^[50] to a group of women after episiotomy with *calendula* ointment and standard care to check whether the patient feels relief or not in this trial 100 women were agreed in which a group of 50 women were treated with *calendula* ointment and other 50

women got standard care the result came out be the women treated with calendula ointment feels lower pain than the women with standard care .

Anti – inflammatory

Ukiya et al.,^[51] got to know that calendula oil is known for its anti-inflammatory properties, making it a popular choice in many skin care products. The oil contains numerous active compounds, including terpenoids, which are known for their therapeutic benefits. Terpenoids are a diverse group of compounds that are found in many plants, and they have been shown to possess anti-inflammatory, antioxidant, and antitumor properties. When applied topically, calendula oil has been shown to reduce inflammation and redness in the skin. This makes it an effective treatment for a variety of skin conditions, including eczema, psoriasis, and acne. Calendula oil can also be used to soothe sunburned skin and to promote healing of minor cuts and grazes. One of the main terpenoids found in calendula oil is alpha-pinene. This compound has been shown to have anti-inflammatory effects, making it an important component of the oil's therapeutic properties. Another terpenoid found in calendula oil is beta-caryophyllene, which has been shown to have analgesic (pain-relieving) effects. Overall, the anti-inflammatory effects of calendula oil make it a valuable addition to any skin care routine. Whether you are dealing with a specific skin condition or simply want to promote healthy, glowing skin, calendula oil can help to reduce inflammation and promote healing.

Mucositis

Mucositis is when your mouth or gut is sore and inflamed. It's a common side effect of chemotherapy and radiotherapy for cancer. Although mucositis is usually painful, it can be treated. Babae et . al.,^[52]found that *c. officinalis* treats oral mucositis by reducing the intensity of high radial scavenging activity , also it acts as a shield against the oxidative stress produced by high level of reactive oxygen species.

Oral health

Roverovi – favaretto LH et.al.,^[53] examined the *c. officinalis* as a promising treatment for exfoliative cheilitis . when the unerupted third molars was extracted and it was treated with calendula officinalis containing mouthwashes it minimises the amount of microbes which are adhered to the sutures .

Anthelminthic

Dorwal D et.al.,^[54] on investigation of anthelmintic activity of *c . officinalis* has found that the methanolic and ethanolic extracts of leaves of *c. officinalis* has anthelmintic activity in-vitro against earthworm & pheretima posthuma.

Anti – bacterial activity

Hamadet.al.,^[55] on doing the extraction of *c. officinalis* flower found that it has ant-bacterial property against many bacteria. The essential oil of flowers In-vitro inhibited the growth of many gram-positive bacteria including staphylococcus aureus and bacillus subtilis , and also gram-negative bacteria including *P.aeruginosa* anf *E . coli* and shows maximum inhibition for *P.aeruginosa* . The MIC value comes out to be >2048 mg/l.

Anti-fungal activity

Gazim et.al.,^[56] has found that the volatile oil present in flower of *c. officinalis* has anti-fungal activity against various fungi as well as their strains such as candida albicans , candida parapsilosis.

Antiviral activity

The second round of covid-19 may lead to more confusion and put more pressure on public health systems . S. Meenatchisundaram et.al.,^[57] go to know in his finding that the replication of herpes simplex ; influenza A2 and influenza APR-8 viruses is suppressed by a tincture of the plant c.officinalis flowers . He observed that the chloroform extract of the c.officinalis flower inhibit the replication of HIV-1 in –vitro(IC₅₀0.4mg/ml).

Anti-HIV activity

Z Kalvatchev et.al.,^[58] performed a research to check the anti-HIV activity of c. officinalis to evaluate this a syncytium formation inhibition assay was performed . the interaction between uninfected Molt-4 cells and U-937/HIV-1 infected cells produced typical syncytium formation in absence of fusion-blocking agents . when the test was performed with aqueous extracts it was less effective in suppressing syncytium formation , while treatment with organic extract strongly influenced the subsequent fusion process and completely protected it for 24h the uninfected Molt-4 cells from death , caused by U-937/HIV-1 cells . The organic extract from C. officinalis flowers caused a significant reduction of HIV-1 RT activity in-vitro.

Neuroprotective effect

B.D.shrivasharan et.al.^[59], has found that the plant c. officinalis L. flower has neuroprotective activity against Monosodium glutamate induced neurotoxicity . Monosodium glutamate is good as a flavouring agent but it's excess can cause oxidative stress due to which neurotoxicity occurs .

Anti-cancer and palliative care

Calendula Officinalis has shown potential in the fight against cancer due to its various phyto-chemicals. Studies have shown that certain compounds found in the plant can induce apoptosis, the process of programmed cell death, in cancerous cells.

One such compound is flavonoids, which have been found to be effective in treating various types of cancer, including breast and ovarian cancer. These compounds work by inhibiting the growth of cancer cells and preventing them from metastasizing to other parts of the body.

Another compound found in Calendula Officinalis is triterpenoids, which have also been found to have anti-cancer properties. Triterpenoids work by inducing apoptosis in cancerous cells and inhibiting tumor growth.

In addition to its anti-cancer properties, Calendula Officinalis has also been found to have anti-inflammatory and antioxidant effects, making it a valuable herb in supporting overall health and wellness. While more research is needed to fully understand the potential of Calendula Officinalis in the fight against cancer, these initial findings are promising and suggest that this plant could play an important role in future cancer treatments.^[60]

Spasmolytic and spasmogenic activity

The spasmolytic activity was found in c. officinalis due to blockade of calcium channel . when a research was performed on rabbit jejunum by BashirS. et .al ^[61], with aqueous – ethanol extract of c. officinalis flowers then it shows that there is a rapid relaxation and k⁺ - induced contraction in dose dependant (0.03-3.0mg/ml) ; while breakdown of the extract with dichloromethane showed inhibition of spontaneous contractions in a dose dependant (0.01-0.3 mg/ml) , which is more potent than the parent crude extract.

Hepatoprotective activity

Acetaminophen produces 100% mortality at dose of 1gm/kg in mice , when 30 male albino rats with acetaminophen induced hepatic damage was investigated against 80% methanolic extract of c. officinalis by Ali J et . al., it was found that pretreatment of mice with c.officinalis (1.0gm/kg)reduced the mortality to 30%. Three successive doses of leaves extract restricted the hepatic damage by acetaminophen^[62].

Table 4. different researches done on calendula officinalis by different scientist in respective year .

S.no	Pharmacological activity	Researcher/year	finding	reference
1	Anti – inflammatory activity	Alexander et al.,/2018	Reduction of burn swellings in rat by using a cream with the addition of ethanol flower extract.	63
2	Wound healing	Buzzi et al.,/2016	Increase in the rat of new blood vessel formation in skin wound in rats (water flower extracts)	64
3	Antibacterial activity	Arora et al.,/2013	Water and methanol flower extracts inhibit both gram positive and gram negative bacteria	65
4	Antifungal activity	Faustino et al.,/2018	Growth inhibition of Candida strain: C. albicans, C. dubliniensis, C. glabrara, C. krusei and C. parapsilosis (flower essential oil)	66
5	Antiviral activity	Muley et al.,/2009	Inhibition of HIV replication (organic solvent flower extracts)	67
6	Antitrichomona activity	Samochowicz et al.,/1997	Growth inhibition of Trichomonas vaginalis protozoan (components of the essential oil)	68
7	Antioxidant activity	Lima et al./ 2017	reduction of malondialdehyde (MDA) concentration in periodontitis in rats (water flower extracts)	69
8	Skin brightening effect	Xuan et al.,/2019	Inhibition of melanin production induced by alpha melanocyte-stimulating hormones in melanoma cell(flower ethyle acetate extract)	70
9	Spasmolytic activity	Arora et al.,/2013	Inhibition of spontaneous intestine contraction (water-ethanol flower extract)	65
10	Antidiabetic and hypolipemic activity	Singh et al., /2011	Reduction in blood and urine glucose level in diabetic-induced rats (water-ethanol flower extract)	71
11	Hepatoprotective and hepatoregenerative activity	Toropova et al.,/2017	Increase in the activity of reduced glutathione enzymes, superoxide dismutase, catalase and increase of adenosine triphosphate content in	72

			hepatocytes in the rat model of acute hepatitis (flower extract)	
12	Pancreas regenerating activity	Kaur et al./2016	Increase in the production of nucleic acids, proteins, pancreatic amylase, and reduction of pancreatic oxidative stress in cells of pancreatic parenchyma (ethanol flower extract)	73
13	Cardioprotective activity	Singh et al./2011	Cardioprotective effect by regulating blood pressure and flow in the aorta and left ventricle (flower extracts)	71
14	Antitumor activity	Lovecka et al./2018 Muley et al./2009	Cytotoxic effect on cell lines: colon cancer, leukemia, melanoma and breast cancer (c. officinalis triterpenoid glycosides), inhibiting the growth of human liver cancer cells (flower extracts)	74 67
15	Immunostimulatory activity	Muley et al./2009 Arora et al./2013	Increase in cell phagocytosis (c. officinalis polysaccharide fraction)	67 65
16	Neuroprotective activity	Shivsharan et al./2013	Reduction of oxidative damage and striatal neuronal loss in rats with induced neurotoxicity (ethanol flower extract)	75

Conclusion and final thoughts on the beauty of Calendula

In conclusion, Calendula is a versatile flower with incredible skincare benefits that have been known for centuries. From its anti-inflammatory properties to its ability to soothe and heal irritated skin, Calendula is a powerful ingredient that should not be underestimated. Whether you suffer from dry, sensitive, or acne-prone skin, Calendula can help to improve your complexion and leave you with healthy, glowing skin. Its natural healing properties make it a powerful ingredient in skincare products, and it's no wonder why it has become increasingly popular in the beauty industry. In addition to its skincare benefits, Calendula is also a beautiful flower that can be used in a variety of other ways. From decorating your home to adding a pop of color to your garden. It's amazing to think that such a simple flower can have such a profound impact on our skin and overall well-being. Incorporating Calendula into your skincare routine is a great way to take advantage of its many benefits. Whether you choose to use a Calendula infused face mask, facial oil, or lotion, you'll be doing your skin a favour by introducing this powerful ingredient into your routine. So why not give it a try and experience the beauty of Calendula for yourself.

References

1. Kindersley D. The Encyclopedia of Medicinal Plants, A Practical Guide to Over 550 Key Herbs & their Medicinal Uses. First Published in Great Britan. 1996; 65.
2. AshwlayanVD, Kumar A, Verma M, et al. Therapeutic Potential of *Calendula officinalis*. Pharm Pharmacol Int J. 2018;6(2):149–155. DOI: 10.15406/ppij.2018.06.00171.
3. Chakraborty GS. Phytochemical screening of *Calendula officinalis* Linn leaf extract by TLC. Int J Res Ayurveda Pharm. 2010;1(1):131–134.
4. Arora D, Rani A, Sharma A. A review on phytochemistry and ethnopharmacological aspects of genus *Calendula*. Pharmacogn Rev. 2013 Jul;7(14):179-87. doi: 10.4103/0973-7847.120520. PMID: 24347926; PMCID: PMC3841996.
5. AR Mullaicharam , Nirmala Amaresh , and Hemalatha Balasubramanian , Phytochemistry and Pleiotropic Pharmacological Properties of *Calendula officinalis* - A Review. Received: 20/07/2014 , Accepted: 27/08/2014 , e-ISSN:2321-6182 , p-ISSN:2347-2332
6. PDR for Herbal Medicines. Medical Economics Company: Montvale; 2003. 1106p.
7. Bisset NG, Wichtl M. 2nd ed. Stuttgart, Germany: Medpharm Scientific Publishers; 2001. Herbal Drugs and Phytopharmaceuticals; pp. 118–20.
8. Booth CO. Vol. 2. Delhi: Daya Books; 1999. Encyclopaedia of Garden Plants; pp. 202–3.
9. Mills SY. Harmondsworth, Middlesex: Penguin Books Ltd; 1992. The Essential Book of Herbal Medicine.
10. Loudon J. London: W. Smith; 1811. The Ladies' Flower-Garden of Ornamental Annuals; p. 206.
11. Tutin TG. Vol. 4. Cambridge, United Kingdom: University Press; 1976. Flora Europaea: Plantaginaceae to Compositae (and Rubiaceae) pp. 206–7.
12. Naved T, Ansari SH, Mukhtar HM et al. New triterpenic esters of oleaneneseries from the flowers of *Calendula officinalis* Linn. Indian Journal of Chemistry. 44(5):1088–1091.
13. Adler G, Kasprzyk Z. Free sterols, steryl esters, glycosides, acelyted glycosides and watersoluble complexes in *Calendula officinalis*. Phytochem. 1975;14(3):627–631.
14. Wilkomirski B. Pentacyclic triterpene triols from *Calendula officinalis* flowers. Phytochem. 1985;24(12):3066–3067.
15. Zittwel-Eglseer K, Sosa S, Jurenitsch J, et al. Anti-oedematous activities of the main triterpenoid esters of marigold (*Calendula officinalis* L.). J Ethnopharmacol. 1997;57(2):139-144.
16. Sliwowski J, Dziewanowska K, Kasprzyk Z. (1973) Ursadiol: A new triterpene diol from *Calendula officinalis* flowers. Phytochem. 1973;12(1):157–160.
17. Vecherko LP, Sviridov AF, Zinkevich EP, et al. Structures of calendulosides G and H from the roots of *Calendula officinalis*. Chem Nat Compd. 1974;10(4):548–549.
18. Kurkin VA, Sharova OV. Flavonoids from *Calendula officinalis* flowers. Chem Nat Compd. 2007;43(2):216–217.
19. Vidal-Ollivier E, Elias R, Faure F, et al. Flavonol glycosides from *Calendula officinalis* flowers. Planta Med. 1989;55(1):73–74.
20. Ukiya M, Akihisa T, Yasukava K, et al. Anti-inflammatory, antiTumor Promoting and Cytotoxic Activities of Constituents of Marigold (*Calendula officinalis*) Flowers. J Nat Prod. 2006;69(12):1692–1696.
21. Kerkach AI, Komissarenko NF, Chernobai VT. Coumarines of the inflorescences of *Calendula officinalis* and *Helichrysum arenarium*. Chem Nat Compd. 1986;22(6):722–723.
22. Janiszowska W, Michalski W, Kasprzyk Z. Polyprenyl quinones and α -tocopherol in *Calendula officinalis*. Phytochem. 1976;15(1):125–127.
23. Okoh OO, Sadimenko AA, Afolayan AJ. The effects of age on the yield and composition of the essential oils of *Calendula officinalis*. J Appl Sci. 2007;7(23):3806–3810.
24. Bako E, Deli J, Toth G. HPLC study on the carotenoid composition of *Calendula* products. J Biochem Biophys Methods. 2002;53(1-3):241–250.
25. Goodwin TW. Studies in carotenogenesis: the carotenoids of the flower petals of *Calendula officinalis*. Biochem J. 1954;58(1):90–94.
26. Varlijen J, Andras L, Hildebert W. Structural analysis of rhamnoarabinogalactans and arabinogalactans with immune-stimulating activity from *Calendula officinalis*. Phytochem. 1989;28(9):2379–2383.
27. Abajova RL, Aslanov SM, Mamedova ME. Amino acids of *Calendula officinalis*. Chem Nat Compd. 1994;30(5):641.
28. Vlchenko NT, Glushenkova AI, Mukhamedova KS. Lipids of *Calendula officinalis*. Chem Nat Compd. 1998;34(3):272–274.

29. Wilkomirski B, Kasprzyk Z. Free and ester-bound triterpene alcohols and sterols in calendula flowers. *Phytochemistry*. 1979;18(2):253–255.
30. Zitterl-eglseer K, Sosa S, Jurenitsch J, Schubert-Zsilavec M, Della Loggia R, Tubaro A, et al. Anti-oedematous activities of the main triterpendiol esters of marigold (*Calendula officinalis* L.). *J Ethnopharmacol* 1997;57:139-44.
31. Wojciechowski Z, Jelonekiewicz-Konador A, Tomaszewski M, Jankowski J, Kasprzyk Z. The structure of glucosides of oleanolic acid isolated from the roots of *Calendula officinalis* flowers. *Phytochem* 1971;10:1121-4.
32. Vecherko LP, Sviridov AF, Zinkevich EP, Kogan LM. The structure of calendulose C and D from the roots of *Calendula officinalis*. *Khim Prir Soed* 1975;3:366-73.
33. Ukiya M, Akihisa T, Yasukawa K, Tokuda H, Suzuki T, Kimura Y. Anti-inflammatory, anti-tumor-promoting, and cytotoxic activities of constituents of marigold (*Calendula officinalis*) flowers. *J Nat Prod* 2006;69:1692-6.
34. Naved T, Ansari SH, Mukhtar HM, Ali M. New triterpenic esters of oleanene-series from the flowers of *Calendula officinalis* Linn. *Med Chem* 2005;44:1088-91.
35. Kurkin VA, Sharova OV. Flavonoids from *Calendula officinalis* flowers. *Khim Prir Soed* 2007;2:179-80.
36. Vidal-Ollivier E, Balansard G. Revised structures of triterpenoid saponins from the flowers of *Calendula officinalis*. *J Nat Prod* 1989;52:1156-59.
37. Kerkach AI, Komissarenko NF, Chernobai VT. Coumarines of the inflorescences of *Calendula officinalis* and *Helichrysum arenarium*. *Chem Nat Compd* 1986;22:722-723.
38. Nicoletta CB, Marongiu PA, Pivetta T, Procedda S. Extraction, separation, and isolation of volatiles and dyes from *Calendula officinalis* L. and *Aloysia trphylla* (L'Her) britton by supercritical CO₂. *J Essent Oil Res* 2003;15:272-7.
39. Khalid KA, Teixeira da Silva JA, Biology of *Calendula officinalis* Linn.: Focus on pharmacology, biological activities and agronomic practices. *Med Aromat Plant Sci Biotechnol* 2012;6:12-27.
40. Janiszowska W, Michalski W, Kasprzyk Z. Polyprenyl quinones and α -tocopherol in *Calendula officinalis*. *Phytochem* 1976;15:125-27.
41. Iatsyno AI, Belova LF, Lipkina GS, Sokolov SI, Trutneva EA. Pharmacology of calendulose B, a new triterpene glycoside from the roots of *Calendula officinalis*. *Farmakol Toksikol* 1978;41:556-60.
42. Shivasharan BD, Nagakannan P, Thippeswamy BS, Veerapur VP. Protective effect of *Calendula officinalis* L. flowers against monosodium glutamate induced oxidative stress and excitotoxic brain damage in rats. *Indian J Clin Biochem*, 28(3), 2013, 292-298.
43. Muley BP, Khadabadi SS, Banarase NB, et al. The Antioxidant Activity of the Leaves and Petals of *Calendula officinalis* Linn. *Res J Pharm Tech*. 2(1):173–175.
44. Wagner H, Proksch A, Riess MI, Vollmar AS. Odenthal, Stuppner H, Jurcic K, Le Turdu M and Fang Jn.. Immunstimulierend wirkende Polysaccharide (Heteroglykane) aus höheren Pflanzen. *Arzneimittel-Forschung*, 7, 1985, 1069-1075.
45. Chakurski I, Matev M, Stefanov G, Koichev A, Angelova I. Treatment of duodenal ulcers and gastroduodenitis with a herbal combination of *Symphitum officinalis* and *Calendula officinalis* with and without antacids. *Vutr Boles*, 20, 1981, 44- 47.
46. Lohani, A.; Morganti, P. Age-Defying and Photoprotective Potential of Geranium/Calendula Essential Oil Encapsulated Vesicular Cream on Biochemical Parameters against UVB Radiation Induced Skin Aging in Rat. *Cosmetics* 2022, 9, 43. <https://doi.org/10.3390/cosmetics9020043>.
47. Fonseca YM, Catini CD, Vicentini FT, Cardoso JC, Cavalcanti De AJRL, Vieira Fonseca MJ. Efficacy of marigold extract-loaded formulations against UV-induced oxidative stress. *J Pharm Sci*, 100(6), 2011, 2182-2193.
48. Alexenizor M, Dorn A. Screening of medicinal and ornamental plants for insecticidal and growth regulating activity. *J Pestic. Sci*, 2007; 80: 205-215.
49. Chandran PK, Kutton R. Effect of *Calendula officinalis* flower extract on acute phase proteins, antioxidant defense mechanism and granuloma formation during thermal burns. *J Clin Biochem Nutr*, 2008; 43: 58-64.
50. De Angelis, C., Di Stadio, A., Vitale, S., Saccone, G., Angelis, M. C. D., Zizolfi, B., & Di Spiezio Sardo, A. (2020). Use of calendula ointment after episiotomy: a randomized clinical trial. *The Journal of Maternal-Fetal & Neonatal Medicine*, 1–5.
51. Ukiya M, Akihisa T, Yasukawa K, Tokuda H, Suzuki T and Kimura Y (2006) Anti-inflammatory, anti-tumor promoting and cytotoxic activities of constituents of marigold (*Calendula officinalis*) flowers *J Nat Prod* 69 1692-1696.

52. Babae N, Moslemi D, Khalilpour M, Vejdani F, Moghadamnia Y, Bijani A, et al. Anti-oxidant capacity of *Calendula officinalis* flowers extract and prevention of radiation induced oropharyngeal mucositis in patients with head and neck cancers: A randomised controlled clinical study. *DARU Journal of Pharmaceutical Sciences*. 2013;21(1):18-24.
53. Roveroni-Favaretto LH, Lodi KB, Almeida JD. Topical *Calendula officinalis* L. successfully treated exfoliative cheilitis: A case report. *Cases J*. 2009;23:9077. Doi: 10.1186/1757-1626-2-9077.
54. Dorwal D. Anthelmintic activity of methanolic and ethanolic leaf extract of *Calendula officinalis*. *International Journal of Research in Pharmaceutical and Biomedical Sciences*, 3(2), 2012, 831-833.
55. Hamad M N, Mohammed H J and Merdaw M A (2011) Antibacterial activity of *Calendula officinalis* flowers In vitro Ibn Al- Haitham J For Pure & Appl Sci 24 3 .
56. Gazim Z C, Rezende C M, Fraga S R and Svidzinski T I E (2008) Antifungal activity of the essential oil from *Calendula officinalis* L. (Asteraceae) growing in Brazil *Braz J Microbiol* 39 61-63.
57. S.Meenatchisundaram, G.Parameswari, T.Subbraj, T.Suganya and A.Michael , Note on Pharmacological Activities of *Calendula officinalis* L. Department of Microbiology, PSG College of Arts and Science, Coimbatore, India , Issued 04 January 2009.
58. Z Kalvatchev , R Walder, D Garzaro , Anti-HIV activity of extracts of *calendula officinalis* flowers. *Biomed Pharmacother*. 1997;51(4):176-80. Doi: 10.1016/s0753-3322(97)85587-4. PMID: 9207986.
59. B. D. Shivasharan , P. Nagakannan , B. S. Thippeswamy , V. P. Veerapur . Protective Effect of *Calendula officinalis* L. Flowers Against Monosodium Glutamate Induced Oxidative Stress and Excitotoxic Brain Damage in Rats , *Ind J Clin Biochem* (July-Sept 2013) 28(3):292–298, Received: 23 July 2012 / Accepted: 27 August 2012 / Published online: 26 September 2012 , DOI 10.1007/s12291-0.
60. Cruceriu D, Balacescu O, Rakosy E. *Calendula officinalis*: Potential Roles in Cancer Treatment and Palliative Care. *Integr Cancer Ther*. 2018 Dec;17(4):1068-1078. doi:10.1177/1534735418803766. Epub 2018 Oct 5. PMID: 30289008; PMCID: PMC6247547.
61. Bashir S, Janbaz KH, Jabeen Q and Gilani AH. Studies on Spasmogenic and Spasmolytic Activities of *Calendula officinalis* flowers. *Phytother Res*, 2006; 20: 906-910.
62. Ali J, Khan A. Preventive and Curative Effects of *Calendula-Oficinalis* Leaves extract on Acetaminophen-Induced Hepatotoxicity. *JPMI*. 2006;20(4):370–373.
63. Alexandre, J.T.M., Sousa, L.H.T., Lisboa, M.R.P., Furlan eto, F.A.C., Do Val, D.R., Marques, M., Vasconcelos, H.C., Matos de Melo, I., Leitao, R., Brito G.A.C., Goes, P. (2018). Anti-inflammatory and antiresorptive effects of *Calendula officinalis* on inflammatory bone loss in rats. *Clin. Oral Investig.*, 22(6), 2175–2185. DOI: 0.1007/s00784-017-2308-7.
64. Buzzi, M., Freitas, F. de, Barros Winter, M. de (2016). Therapeutic effectiveness of a *Calendula officinalis* extract in venous leg ulcer healing. *J. Wound Care*, 25(12), 732–739. DOI: 10.12968/jowc.2016.25.12.732.
65. Arora, D., Rani, A., Sharma, A. (2013). A review on phytochemistry and ethnopharmacological aspects of genus *Calendula*. *Pharmacog. Rev.*, 7(14), 179. DOI: 10.4103/0973-7847.120520.
66. Faustino, M.V., Pinto, D.C.G.A., Gonçalves, M.J., Salgueiro, L., Silveira, P., Silva, A.M.S. (2018). *Calendula* L. species polyphenolic profile and in vitro antifungal activity. *J. Funct. Foods*, 45, 254–267. DOI: 10.1016/j.jff.2018.04.013.
67. Muley, B.P., Khadabadi, S.S., Banarase, N.B. (2009). Phytochemical constituents and pharmacological activities of *Calendula officinalis* Linn (Asteraceae): A review. *Trop. J. Pharm. Res.*, 8(5), 455–465. DOI: 10.4314/tjpr.v8i5.48090.
68. Samochowicz, E., Urbanska, L., Manka, W., Stolarska, E. (1979). Assessment of the action of *Calendula officinalis* and *Echinacea angustifolia* extracts on *Trichomonas vaginalis* in vitro. *Wiad. Parazytol.*, 25(1), 77–81.
69. Lima, M.R., Lopes, A.P., Martins, C., Brito, G.A.C., Carneiro, V.C., Goes, P. (2017). The effect of *Calendula officinalis* on oxidative stress and bone loss in experimental periodontitis. *Front. Physiol.*, 8, 1–9. DOI: 10.3389/fphys.2017.00440
70. Xuan, S.H., Park, Y.M., Park, S.N. (2019). Antimelanogenic and antimigration properties of the ethyl acetate fraction of *Calendula officinalis* flowers on melanoma cells. *Photochem. Photobiol.*, 95(3), 860–866. DOI: 10.1111/php.13064.
71. Singh, M.K., Sahu, P., Nagori, K., Dewangan, D., Alexander, T.K.A., Badwaik, H., Tripathi, D.K. (2011). Organoleptic properties in-vitro and in-vivo pharmacological activities of *Calendula officinalis* Linn.: An overview. *J. Chem. Pharm. Res.*, 3(4), 655–663.
72. Toropova, A.A., Badmaev, N.S., Razuvaeva, Y.G., Nikolaev, S.M., Sambueva, Z.G., Erentueva, A. (2017). Influence of *Calendula officinalis* extract on the antioxidant and energy status of liver in rats with experimental hepatitis. *Eksp. Klin. Farmakol.*, 80(7), 11–14.

73. Kaur, J., Sidhu, S., Chopra, K., Khan, M.U. (2016). *Calendula officinalis* ameliorates l-arginine-induced acute necrotizing pancreatitis in rats. *Pharm. Biol.*, 54(12), 2951–2959. DOI: 10.1080/13880209.2016.1195848.
74. Lovecka, P., Lipov, J., Thumova, K., Macurkova, A. (2018). Characterization of biologically active substances from *Calendula officinalis*. *Curr. Pharm. Biotechnol.*, 19, 1167–1174. DOI: 10.2174/1389201019666180226151910.
75. Shivasharan, B.D., Nagakannan, P., Thippeswamy, B.S., Veerapur, V.P., Bansal, P., Unnikrishnan, M.K. (2013). Protective effect of *Calendula officinalis* Linn. flowers against 3-nitropropionic acid induced experimental Huntington's disease in rats. *Drug Chem. Toxicol.*, 36(4), 466–473. DOI: 10.3109/01480545.2013.776583.

