Quest Journals
Journal of Research in Pharmaceutical Science
Volume 8 ~ Issue 10 (2022) pp: 01-05
ISSN(Online) : 2347-2995
www.questjournals.org

Research Paper

A Phytochemical and Pharmacological Approach of *Calendula Officinalis:* Review.

[1]Komal N. Yadav, [2]Divya S. Ostwal, [3]Rupali R. Bendgude, [4]Sukumar M. Lande.

[1]Lecturer, [2]Lecturer, [3]Associate Professor and Principal, [4]Asst. Professor
Shri Ganpati Institute of Pharmaceutical Sciences and Research, Tembhurni, Dist-Solapur-413211, Maharashtra, India.

Abstract:
Calendula officinalis(Calendula), belonging to the family of Asteraceae, commonly known as English Marigold or Pot Marigold is an aromatic herb which is used in Traditional system of medicine for treating wounds, ulcers, herpes, scars, skin damage, frost-bite and blood purification. It is mainly used because of its various biological activities to treat diseases as analgesic, anti–diabetic, anti-ulcer and anti-inflammatory. It is also used for gastro-intestinal diseases, gynecological problems, eye diseases, skin injuries and some cases of burn. Calendula oil is still medicinally used as, an anti-tumor agent, and a remedy for healing wounds. Plant pharmacological studies have suggested that Calendula extracts have antiviral and anti-genotoxic properties in-vitro. In herbalism, Calendula in suspension or in tincture is used topically for treating acne, reducing inflammation, controlling bleeding, and soothing irritated tissue. Calendula is used for protection against the plague. In early American Shaker medicine, calendula was a treatment for gangrene. In addition to its first aid uses, calendula also acts as a digestive remedy. An infusion or tincture of the flowers, taken internally, is beneficial in the treatment of yeast infections, and diarrhea. An infusion of Calendula officinalismay also be used to treat bee stings, eye inflammations, boils and abscesses, varicose veins, eczema, and as a gargle for mouth sores or to relieve toothache.

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

***R**eceived 19 Sep, 2022; **R**evised 01 Oct., 2022; **A**ccepted 03 Oct., 2022 © The author(s) 2022.*
P**ublished with open access at **www.questjurnals.org

I. Introduction:

*Calendula officinalis*is a well-known therapeutic herb that was used for millennia and belongs to the kingdom plantae, family Asteraceae. It is commonly known as English marigold, pot marigold. Chemically, *Calendula officinalis*possesses various biological active constituents such as carotenoids, flavonoids, saponins, sterols, phenolic acids, lipids, etc. The genus *Calendula* (*Asteraceae*) includes approximately 25 *herbaceous* annual or perennial species, most common being *Calendula officinalis* Linn., *Calendula arvensis* Linn., *Calendula suffruticosa* Vahl., *Calendula stellata* Cav., *Calendula alata* Rech., *Calendula tripterocarpa* Rupr.The genus is native to the Mediterranean countries.

Various parts of plant such as leaves, flowers have been reported to possess therapeutic activity.The flowers were made into extracts, tinctures, balms and salves and applied directly to the skin to help heal wounds and to soothe inflamed and damaged skin. Advanced analytical techniques have been used to isolate novel chemical constituents such as isorhamnetin, rutin, quercetinglucoside, which are biologically active as well as used in food and cosmetic industry.

The plant has yellow or orange coloured flowers which are used as food, dye, spice, tea, ointment or cream in cosmetics. It possesses cytotoxic as well as tumor reducing potential. Traditionally, *Calendula officinalis*was used as anti-inflammatory, diaphoretic, analgesic, antiseptic and in jaundice treatment.It is believed to have medicinal properties and is widely used as an anti-inflammatory, diaphoretic, analgesic, and antiseptic. It is used to treat gastrointestinal issues, gynaecological issues, oral disorders, eye diseases, skin injuries, and certain burns, among other things.

Fifteen amino acids were discovered in the free state in the leaves, stems, and flowers. Flowers were turned into extracts, tinctures, and balms for external application, and were therapeutically used to treat skin inflammations, open, lacerated wounds, and bleeding wounds.

*Calendula officinalis*has medicinal capabilities that have been stated in the Ayurvedic and Unani systems of medicine. Carophyllenic ointment (containing carotenoids obtained from the flowers) and pot marigold tincture are two recent *Calendula officinalis*treatments. It is one of the ingredients in the homoeopathic drug, which is used to relieve the pain and oedema associated with acute musculoskeletal injuries.Medicinal properties of *C. officinalis* have been mentioned in Ayurvedic and Unani system of medicine indicating that leaves and flowers are antipyretic, anti-inflammatory, antiepileptic and antimicrobial.In traditional and homoeopathic medicine, *C. officinalis* has been used for poor eyesight, menstrual irregularities, varicose veins, hemorrhoids and duodenal ulcers. In the middle ages, *Calendula* flowers were used for liver obstructions, snake bites and to strengthen the heart. It was used in the 18th century as a remedy for headache, jaundice and red eyes. The plant was employed in the civil war to treat wounds and as a remedy for measles, smallpox and jaundice.

The traditional usage and clinical significance of *Calendula* species are highlighted in this review paper. It is aimed to attract attention of natural product researchers from around the world to the enormous potential and diverse biological activities in treatment aspects. Furthermore, the authors emphasise its key function in both general and oral treatment.

Taxonomic classification of Calendula officinalis:

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

Description:

Calendula officinalis is a short-lived aromatic herbaceous perennial, growing to 80cm (31in) tall, with sparsely branched lax or erect stems. The leaves are oblong-lance. The disc florets are tubular and hermaphrodite, and generally of a more intense orange olate, 5–17cm (2–7in) long, hairy on both sides, and with margins entire or occasionally waved or weakly toothed. The inflorescences are yellow, comprising a thick capitulum or flower head 4–7cm diameter surrounded by two rows of hairy bracts; in the wild plant they have a single ring of ray florets surrounding the central disc florets-yellow colour than the female, tridentate, peripheral ray florets. The flowers may appear all year long where conditions are suitable. The fruit is a thorny curved achene.

Photochemistry of *Calendula officinalis:*

A number of phytochemical studies have well reported about the presence of several classes of chemical compounds, the main ones being terpenoids, flavonoids, coumarines, quinines, volatile oil, carotenoids and amino acids in the plant.

Flavonoids: Various flavonoids have been isolated from the ethanol extract of the inflorescence of *C. officinalis*. They include quercetin, isorhamnetin, isoquercetin, isorhamnetin-3-O-D-glycoside, narcissin, calendoflaside, calendoflavoside, calendoflavobioside, rutin, isoquercetinneohesperidoside, isorhamnetin-3-Oneohesperidoside, isorhamnetin-3-O-2G- rhamnosylrutinoside, isorhamnetin-3-Orutinoside, quercetin-3-O-glucoside and quercetin-3-O-rutinoside.

Coumarins: The ethanol extract of the inflorescence of the *C. officinalis* reported to contain coumarins-scopoletin, umbelliferone and esculetin.

Volatile oil: *C. officinalis* flowers contain maximum volatile oil at full flowering stage (0.97 %) and minimum during the pre-flowering stage (0.13%). The composition also showed different patterns at different phases of vegetative cycles. Various monoterpenes and sesquiterpenes have been reported in the volatile oil : α-thujene, α-pienene, sabinene, β-pienene, limonene, 1,8-cineol, p-cymene, trans-β-ocimene, ϒ-terpenene, δ-3-carene, nonanal, terpene-4-ol, 3-cylohexene-1-ol, α-phellandrene, α-terpeneol, geraniol, carvacrol, bornyl acetate, sabinyl acetate, α-cubebene, α-copaene, α-bourbonene, cubebene, α-gurjunene, aromadendrene, β-aryophyllene, α-ylangene, α-humulene, epibicyclosequiphellandrene, germacrene D, alloaromadendrene, β-saliene, calarene,

muurolene, δ-cadinene, cadina 1,4-diene, α-cadinene, nerolidol, palustron, endobourbonene, oplopenone, α-cadinol, Tmuurolol. The essential oil was found to be rich in α-cadinene, α-cadinol, t-muurolol, limonene, and 1,8-cineol with p-cymene at lower levels at the post-flowering periods

Quinones: Quinones reported from *C. officinalis* were plastoquinone, phylloquinone, and tocopherol in the chloroplast, ubiquinone, phylloquinone, tocopherol in mitochondria, and phylloquinone in the leaves.

Carotenoids: The methanol extract of leaves, petals and pollens of *C. officinalis* flowers showed a number of carotenoids. The carotenoids found in the pollens and petals were neoxanthin, 9Z-neoxanthin, violaxanthin, luteoxanthin, auroxanthin, 9Z-violaxanthin, flavoxanthin, mutatoxanthin, 9Zanthroxanthin, lutein, 9/9ʻA-lutein, 13/13ʻZlutein, α-cryptoxanthin, β-cryptoxanthin, z-cryptoxanthin, lycopene, α-carotene, and β-carotene. Total carotenoid (mg/g dry weight) was 7.71% for petals and 1.61% for pollens. Carotenoid compositions of the leaves and stems were reported as neoxanthin, 9Zneoxanthin, violaxanthin, luteoxanthin, 9Zviolaxanthin, 13Z-violaxanthin, antheraxanthin, mutatoxanthinepimer 1, mutatoxanthinepimer 2, lutein, 9/9ʻ2-lutein,α-cryptoxanthin, β-cryptoxanthin, β-carotene. Total carotenoids (mg/g dry weight) for the leaves is 0.85% and for stems 0.18%.

Amino acids: The ethanol extract of the flowers of the plant is reported to show the presence of 15 amino acids in free form: Alanine, arginine, aspartic acid, asparagines, valine, histidine, glutamic acid, leucine, lysine, proline, serine, tyrosine, threonine, methionine and phenylalanine. Amino acid content of the leaves is about 5%, stems 3.5% and flowers 4.5%.

Lipids: The lipids in the petroleum ether extract of the seeds, leaves and flowers of *C. officinalis* have been analyzed. The amount of neutral lipids in the seeds was 15.7%, phospholipids 0.6% and glycolipids 0.9%. Fatty acids of monols, sterol esters, 3-monoesters, 3-monoester diols reported in flowers were lauric, myristic, palmitic, stearic, oleic, linoleic and linolenic acid.

Carbohydrates: The ethanol extract of the inflorescence of plant showed the presence of polysaccharides, PS-I,-II, and III having a (1_3)-D-galactam backbone with short side chains at C-6 comprising -araban(1_3)-araban and alpha-L-rhamnan-(1_3)- araban along with monosaccharide's.

Other constituents: Other phytochemicals include the bitter constituent, loliolide (calendin),calendulin andparaffins.

Pharmacological approaches of *Calendula Officinalis:*

The pharmacological effects of *Calendula officinalis*are listed as:

a. Antimicrobial and antihelminthic effects
b. Anti-inflammatory effects
c. Antioxidant and photoprotective effects
d. Cytotoxic effects
e. Genotoxic and antigenotoxic effects
f. Cardiovascular effect
g. Neuroprotective effect
h. Hepatoprotective effect

Antimicrobial Activity: The essential oil of the flowers inhibits the growth in vitro of Bacillus subtilis, Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa and Candida albicans. A flavonoid fraction isolated from the flowers inhibited the growth in vitro of S. aureus, Sarcinalutea, E. coli, Klebsiellapneumoniae and Candida monosa. However, chloroform, ethanol, methanol or water extracts of the flowers did not inhibit bacterial growth in vitro. Acetone, ethanol or water extracts inhibited the growth in vitro of the fungus Neurosporacrassa. Extracts of the flowers inhibited the growth in vitro of Trichomonasvaginalis. Oxygenated terpenes appear to be responsible for the antimicrobial activity. Extracts of the flowers inhibits the growth in vitro of Trichomonasvaginalis. Oxygenated terpenes appear to be responsible for the antimicrobial activity.

Antioxidant and photoprotective effects: *Calendula officinalis*leaves and petals may be a natural source of antioxidants. It was reported that *Calendula* extract scavenges hydroxyl radicals and superoxide radicals which is produced by photo reduction of riboflavin.

Antihelminthic effects: The *Calendula officinalis*plants contain saponins and have also demonstrated anthelmintic action, indicating that saponins have anthelminthic activity.

Neuroprotective effect:*Calendula officinalis*extracts also have modest sedative effects and can work in conjunction with sedative drugs like barbiturates. The Central Nervous System (CNS) inhibitory impact of aqueous alcoholic extract of florets was also observed, as well as sedative action.

Cardiovascular effect:*Calendula* extract has been found to reduce the size of myocardial infarction. It seems that cardio protection is achieved by changing the ischaemia-reperfusion-mediated death signal into a survival signal.

Anti-inflammatory effects:*Calendula officinalis*preparations are mostly used as a wound healing medicine for inflammations of the skin, mucous membranes, tissue repair, scars, blisters, and allergic rashes in the form of infusions, tinctures, and ointments. *Calendula* extract cream has been shown to be beneficial in the treatment of burn oedemas. *Bacillus subtilis*, *Escherichia coli*,*Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*were all inhibited in-vitro by the essential oil from the flowers.

Hepatoprotective effect:*Calendula officinalis*extracts were found to have potential hepatoprotective properties against cytotoxicity and oxidative stress caused by carbon tetrachloride. It raises total haemoglobin levels. The extract has a comparable consistency to insulin. As a result, the research clearly reveals that *Calendula officinalis*hydro alcoholic extract has both antidiabetic and antihyperlipidemic properties.

Wound-healing and angiogenic activities: Angiogenic activity of *Calendula officinalis* L. (Asteraceae) ethanolic extract and dichloromethane and hexanic fractions were evaluated by using Models 36 rats and 90 embryonated eggs to evaluate healing and angiogenic activities of extracts and fractions of the plant, through the induction of skin wounds and the chorioallantoic membrane, respectively. The effect of vascular proliferation was also tested from the study to verify the intensity of expression of vascular endothelial growth factor (VEGF) in cutaneous wounds in rats. In morphometric evaluation increase of the vascular area and of percentage of red-marked areas was observed in CAM treated as positive control 1% (17 ß-estradiol), ethanolic extract 1%, dichloromethane fraction 1% and hexanic fraction 1%, compared to solvent control (ethanol 70%). Digital planimetry by point counting performed on mice dermtrated with ethanolic extract 1% revealed an increase in the number of blood vessels compared to solvent control.

Anticancer activities: The results obtained indicated that none of the extracts had a direct mitogenic effect on human lymphocytes or thymocytes (stimulation index, SI<0.07). Among the plants studied, *C. officinalis* showed a complete inhibitory effect on the proliferation of lymphocytes in the presence of PHA (SI range 0.01-0.49).

References:

[1]. WHO monographs on selected medicinal plants, FlosCalendulae, 37-44.
[2]. Master data/ monograph – calendula officinalis (pot marigold), 2007; 1-5.
[3]. Arora.D, Rani A, Sharma A. A review on phytochemistry and ethnopharmacological aspects of genus Calendula. Pharmacognosy Reviews. 2013;7(14):179. Doi: 10.4103/0973-7847.120520.
[4]. Al-Snafi AE. The chemical constituents and pharmacological effects of *calendula officinalis*- a review. Indian Journal of Pharmaceutical Science & Research. 2015;5(3):172-85.
[5]. Hussein MS, El-Tawil OS, El-HodaYassin N, Abdou KA. The protective effect of morusalba and *calendula officinalis*plant extracts on carbontetrachloride-induced hepatotoxicity in isolated rat hepatocytes. J Am Sci. 2010;6(10):762-73.
[6]. Chakraborthy GS, Arora R, Majee C. Anti-diabetic and Anti-hyperlipidaemiceffect of Hydoalcoholic extract of *Calendula officinalis.* Int Res J Pharm. 2011;2(1):61-65.
[7]. Pommier P, Gomez F, Sunyach MP, D'Hombres A, Carrie C, Montbarbon X. Phase III randomised trial of *Calendula officinalis*compared with trolamine for the prevention of acute dermatitis during irradiation for breast cancer. J ClinOncol. 2004;22(8):1447-53.
[8]. Della-Loggia R et al. The role of triterpenoids in the topical anti-inflammatory activity of Calendula officinalis flowers. PlantaMedica, 1994, 60:516–520.
[9]. Bezakova L et al. Inhibitory activity of isorhamnetin glycosides from Calendula officinalis L. on the activity of lipoxygenase. Pharmazie, 1996, 51:126–127.
[10]. Tyler VE. *The Therapeutic Use of Phytomedicinals.* Herbs of Choice: New York; 1994
[11]. Amirghofran Z, Azadbakht M, Karimi MH. Evaluation of the immunomodulatory effects of five herbal plants. *J Ethnopharmacol*. 2000;72(1-2):167–172.
[12]. Vidal-Ollivier E, Elias R, Faure F, et al. Flavonol glycosides from *Calendula officinalis* flowers. *Planta Med*. 1989;55(1):73–74.
[13]. Ukiya M, Akihisa T, Yasukava K, et al. Anti- inflammatory, anti-Tumor Promoting and Cytotoxic Activities of Constituents of Marigold (*Calendula officinalis*) Flowers. *J Nat Prod*. 2006;69(12):1692–1696.
[14]. Kerkach AI, Komissarenko NF, Chernobai VT. Coumarines of the inflorescences of *Calendula officinalis* and *Helichrysumarenarium. Chem Nat Comp*d. 1986;22(6):722–723.
[15]. Janiszowska W, Michalski W, Kasprzyk Z. Polyprenylquinones and α-tocopherol in *Calendula officinalis*. *Phytochem*. 1976;15(1):125–127.
[16]. Okoh OO, Sadimenko AA, Afolayan AJ. The effects of age on the yield and composition of the essential oils of *Calendulaofficinalis. J Appl Sci*. 2007;7(23):3806–3810.
[17]. Bako E, Deli J, Toth G. HPLC study on the carotenoid composition of *Calendula* products. *J BiochemBiophys Methods*. 2002;53(1-3):241–250.
[18]. Goodwin TW. Studies in carotenogenesis: the carotenoids of the flower petals of *Calendula officinalis*. *Biochem J*. 1954;58(1):90–94.

[19]. Piccaglia R, Marotti M, Avari G, et al. Effects of Harvesting Date and Climate on the Flavonoid and Carotenoid Contents of *Calendula officinalis* L. *Flavour and Fragance Journal*. 1997;12(2):85–90.
[20]. Kishimoto S, Maoka T, Sumitomo K, et.al. Analysis of carotenoid composition in petals of *Calendula officinalis* L. *Biosci BiotechnolBiochem*. 2005;69(11):2122–2128.
[21]. Szakiel A, Janiszowska W. Reversibility of the oleanolic acid monoglycosides transport across the tonoplast in vacuoles isolated from *Calendula officinalis* leaves. *ActaBiochim Pol*. 1997;44(1):55–59.
[22]. Lin LT, Liu LT, Chiang LC et al. In vitro anti-hepatoma activity of fifteen natural medicines from Canada. *Phytother Res*. 2002;16(5):440–444.
[23]. Abajova RL, Aslanov SM, Mamedova ME. Amino acids of *Calendula officinalis*. *Chem Nat Compd*. 1994;30(5):641.
[24]. 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.
[25]. Wagner H, Proksch A, Riess-Maurer I et al. Immunostimulating action of polysaccharides (heteroglycans) from higher plants. *Arzneimitelforschung*. 1985;35(7):1069–1075.