

FLAVONOIDS TO POLYPHENOLS: REVISITING MEDICINAL PLANTS IN THE MANAGEMENT OF SKIN DISEASES

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ABSTRACT

Medicinal plants' natural bioactive compounds and low side effects when compared to synthetic treatments have drawn a lot of attention to their therapeutic potential in dermatology. This review highlights the pharmacological characteristics and effectiveness of the wide variety of plants that have historically been used to treat skin disorders, including psoriasis, acne, eczema, and skin ageing. It has been demonstrated that plants with anti-inflammatory, antioxidant, antibacterial, and wound-healing qualities include aloe vera, sandalwood (*Santalum album*), chamomile (*Matricaria chamomilla*), and Alexandrian laurel. Flavonoids, terpenes, and polyphenols are just a few of the bioactive substances that these plants use to help maintain and repair healthy skin. The study also explores the molecular mechanisms that underpin their therapeutic actions, emphasising the necessity for additional clinical trials to confirm their safety and efficacy in modern dermatological practice. Medicinal plants continue to be a possible option or supplement to traditional skin care treatments.

INTRODUCTION

The skin is the largest organ in the body, making up about 15% of an adult's total weight. It carries out several vital tasks, such as limiting the body's excessive water loss, aiding in thermoregulation, and providing defence against biological, chemical, and physical threats from the outside world. The skin is made up of three layers: dermis, epidermis, and subcutaneous tissue. The epidermis is made up of a type of cell known as keratinocytes,

which are responsible for producing the protective protein keratin. Keratinocytes also allow UV-B radiation absorption in the skin, which is required for vitamin D activation. Keratinocytes also help to manage calcium levels. Collagen, a fibrillar structural protein, is the primary constituent of the middle layer, or [1] dermis. The panniculus, or subcutaneous tissue, also known as the hypodermis, on which the dermis is placed, is composed of tiny lobes of fat cells known as lipocytes.

Depigmentation Of skin:

Melanocytes oxidise hydroquinone to produce melano cytotoxic chemicals, including quinones. The metabolic processes of the melanocyte can be inhibited by these molecules. When pigment cells are destroyed by these cytotoxic chemicals, the result is skin depigmentation. Moreover, hydroquinone acts on the rate-limiting enzyme tyrosinase to prevent the enzymatic oxidation of tyrosine to dopaquinone. Skin irritation and allergic contact dermatitis are common side effects of hydroquinones, particularly in people with darker skin tones. Rare instances of exogenous ochronosis and irreversible depigmentation have been reported with prolonged use. [2]

Inhibition of Melanin Production:

Tyrosinase Inhibition: Tyrosinase is an essential component of melanin production. Reduced melanin synthesis can be achieved by inhibiting its activity. Several skin-lightening agents, including hydroquinone and arbutin, act primarily through tyrosinase inhibition.

Inhibition of Other Enzymes: Reducing melanin synthesis can also be achieved by targeting other melanogenesis-related enzymes, such as the tyrosinase-related proteins TRP-1 and TRP-2.

Skin Antiaging:

Alpha-Tocopherol and Coenzyme Q10

Alpha-tocopherol (Vitamin E) is regenerated and its oxidative degradation prevented by ubiquinol (Coenzyme Q10). Coenzyme Q10 is the only lipid-soluble antioxidant synthesized by animal cells, although its regeneration through enzymatic processes declines with age. Additionally, Coenzyme Q10 supports skin health by preserving collagen content,

promoting the synthesis of key cutaneous proteins through gene induction, and inhibiting the activity of metalloproteinases such as collagenase.[3]

Cellular and Molecular Mechanisms

DNA Repair: Strengthening DNA repair mechanisms helps sustain cellular function and protect against age-related disorders. This involves boosting the activity of enzymes that correct mutations and repair DNA damage.

Telomere Maintenance: With every cell division, telomeres—the protecting ends of chromosomes—get shorter, which accelerates the ageing process. Approaches like activating telomerase aim to preserve or extend telomere length.

Autophagy: This self-cleaning process enables cells to remove damaged components and recycle them. Enhancing autophagy helps maintain cellular health and prevent the buildup of defective proteins and organelles.

Proteostasis: Proper protein balance within cells is essential. Age-related protein dysfunction can be mitigated by promoting chaperone activity and accelerating the removal of misfolded proteins.

Antioxidant: Antioxidants can sometimes act as pro-oxidants as well. Consequently, antioxidant's effectiveness and advantages depend critically on how it is distributed throughout the body. Topically applied antioxidants constitute an important class of pharmacologically active compounds that can both prevent and mitigate UV-induced skin damage and ageing. Superoxide, peroxy and hydroxyl radicals, singlet oxygen, and peroxynitrite are among the reactive oxygen species (ROS) that

antioxidants protect skin cells from oxidative damage. ROS-induced oxidative stress in the skin is linked to photodamage, cancer, inflammation, and ageing.

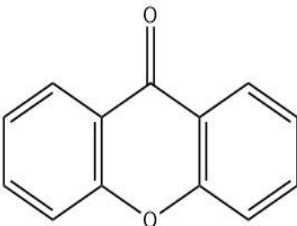
Vitamin E: It neutralises singlet oxygen in the cell membrane, which stabilises the membrane and stops lipid peroxidation, which can rupture the membrane by oxidising unsaturated fatty acids from membrane phospholipids, such as arachidonic acid.

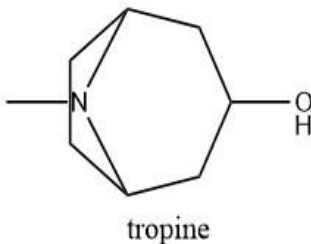
Coenzyme Q10: decreases the production of free radicals and the regeneration of vitamin E, decreases the formation of metalloproteinase in fibroblasts caused by

UVA, and decreases mitochondrial oxidative damage in keratinocyte DNA.

Antiacne:

The main cause of acne beginning and progression is hyperandrogenism, which can lead to increased sebum production, an inflammatory response, hyperkeratinization, bacterial colonisation, and occlusion of the sebum duct. Acne is most common on the face, chest, and upper back because of the large number of sebaceous glands in these areas. [4]
Retinoids: Topical and oral retinoids like tretinoin and isotretinoin reduce sebum production and avoid clogged pores by re-establishing the skin cells' normal shedding in the hair follicle.

S N O	PLANT NAME	PHYTOCONSTITUENTS	SKIN BENEFITS
1	Name: Alexandrian laurel. Synonym: Mastwood, satin touriga, beach touriga. Family :Clusiaceae Biological source : The oil is extracted from the seeds of	Xanthonenes, Coumarins, Benzodipyrone, Terpenes and terpenoids, Tannins, Flavonoids, Esters, Oxygenated, Hydrocarbons, Ethers, Calaustraline, Shikimic acid, Brasilic acid, Carbazole.[5]  Xanthonenes	Anti Aging-By maintaining your skin's elasticity and firmness, it helps prevent wrinkles and, in certain situations, even lessens them. Moisturising-Reducing and preventing breakouts and soothing and moisturising the skin. Wound Healing-Relieving sunburns and small wounds of their burning and redness. Antioxidants-essential for shielding skin from ageing-causing free radicals brought on by exposure to environmental elements like pollution and

	<i>Calophyllum inophyllum</i> .  Fig 1: Alexandrian laure		sunlight.[6]
2	Name: Ashwagandha Synonym: Winter cherry, Varahkarni, Asgandha, Ajagandha, Vajigandha. Family: Solanaceae. Biological source: It is made out of the dried stem bases and roots of <i>Withania somnifera</i>.  Fig 2: Ashwagandha	Steroids, glycosides, flavonoids, phenolics, saponins, phytochemicals, withasomniferanolide, somnifera, withanolides, 3-α-glyoxytropine, withanin, pseudo-withanine, tropine, pseudotropine, anaferrine, Somniferinine.[7]  tropine	Anti Aging-Collagen is a necessary ingredient for preserving the health of the skin since it gives the skin its structure, flexibility, and firmness. Moisturising-With the use facial toner you may decrease the visibility of pores on your skin, revitalise your appearance, eliminate extra oil, and preserve skin hydration. Antioxidants -included in ashwagandha such as ascorbic acid, reduced glutathione, and superoxide dismutase, help shield the skin from oxidative damage brought on by free radicals.[8]

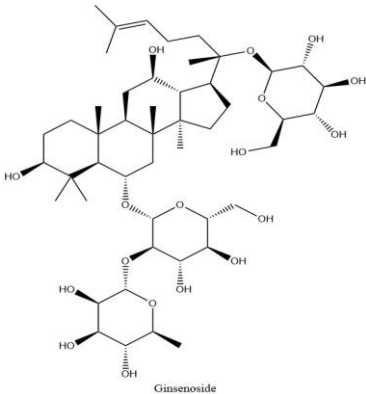
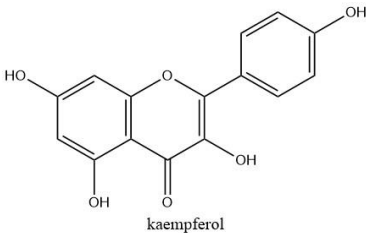
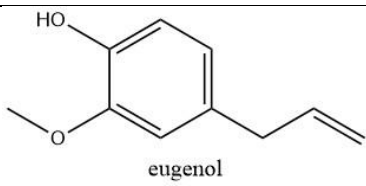
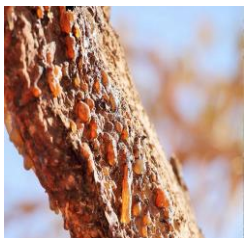
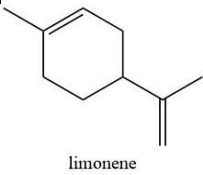
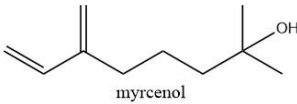
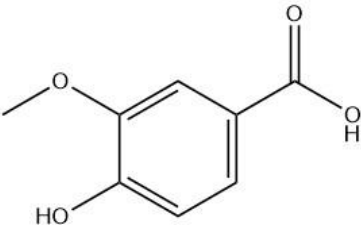
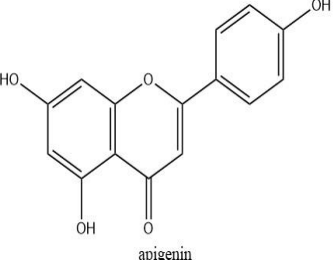
3 Name: Ginseng Synonym: Ginseng, Panax schinseng, Panaxpseudoginseng Family: Araliaceae Biological source: The root is the primary part used, and it can be consumed in various forms such as dried, powdered, or as an extract of <i>Panax ginseng</i>.  Fig 3 :Ginseng	Notoginseng, ginsenosides, saponins, polyacetylene, volatile oil, and polysaccharides such as pectin and starch-like glucans. Dextran and arabinogalactan are examples of glucans that resemble starch. [9]  Ginsenoside	Anti Aging-By controlling matrix metalloproteinases in human fibroblast type I collagen, ginseng extract improves the suppleness and water content of skin. Skin whitening - decreasing wrinkles and other ageing symptoms; increasing collagen synthesis and suppleness; lowering inflammation and puffiness; and lightening or whitening the skin.[10]
4 Name: Asiatic Pennywort Synonym: Coinwort, gotu kola, spadeleaf, Indian pennywort, and Asian pennywort. Family: Apiaceae Biological source: The leaves are the primary parts used often as fresh or dried, Stems of <i>Centella asiatica</i>.	βcaryophylleneSesquiterpenes, plant sterols, pentacyclic triterpenoids, saponins, isoprenoids, Phenylpropanoid derivatives include flavonoids, caffeoylquinic acids, and eugenol derivatives, Flavonoids.[11]  kaempferol	Anti -Aging-Increase the production of collagen, especially type I collagen this may have anti-aging property. Moisturising-Skin surface hydration status was increased and transepidermal water loss was decreased in formulations containing varying doses of <i>Centella asiatica</i> extract. Antioxidant -In addition to helping to improve skin barrier function (decrease in TEWL and pH value), the active ingredients in extract—especially saponins, flavonoids,

	 Fig 4: Asiatic Pennywort	 eugenol	and phenolic acid—show antioxidant.[12]
5	Name: Myrrha Synonym: Common myrrh, Somali myrrhor, African myrrh, and herabol myrrh. Family: Burseraceae Biological source: The primary part used is the gum resin, which is harvested from the bark of the tree. This resin is collected by making incisions in the bark and allowing the gum to ooze out and harden from <i>Commiphora molmol</i>.  Fig 5: Myrrha	pinene, limonene, diterpenes, sesquiterpenes, metacresol, and eugenol. resin up to 40%, acid gums 60%, and esters of another resin (linked to polysaccharides and the enzyme oxidase). Additional ingredients consist of Flavonoids Alkaloids in Tannins Glycoides Steroids Saponins Terpenoid, Sugars .[13]  limonene  myrcenol	Anti-Aging Properties-By lessening the appearance of wrinkles and fine lines, bioactive chemicals found in myrrh help prevent aging. Anti-Inflammatory Effects- Its ability to reduce inflammation can help to calm inflamed skin blushing. Hydrating And Moisturizing- It improves the suppleness and hydration of the skin, giving the appearance of healthier additional water in it. Prevention of Acne-The antibacterial qualities of myrrh aid in the prevention of acne and other skin problems.[14]

6	Name: Wheat Synonym: gehu ,godi Family: Poaceae Biological source: Wheat is obtained from the seeds of the <i>Triticum</i> species, primarily <i>Triticum aestivum</i>.  Fig 6: Wheat	The starchy endosperm also contains 13% proteins, including Vanillic acid, gliadins, albumins, glutenins, and globulins, and 15% lipids. Minerals and dietary fibres are present in little amounts—0 or 5% and 1 or 5%, respectively. [15]  vanillic acid	Anti Acne-beneficial for oily and acne-prone skin because of its absorbent qualities, which can help reduce the production of excess oil. Hydration: <u>wheat</u> kernel, wheat germ oil works wonders as a moisturiser. It can increase the texture of the skin and keep the skin hydrated. Anti-Inflammatory Properties: reduce eczema and acne since it may relieve inflamed skin and lessen redness.[16]
7	Name: Chamomile Synonym: German chamomile Family: Asteraceae Biological source: The dried flower heads of <i>Matricaria chamomilla</i> which are rich in flavonoids and essential oils, are its biological source  Fig 7: Chamomile	Flavonoids like luteolin, apigenin, and quercetin; coumarins like umbelliferone; terpenoids like α-bisabolol, α-bisabolol oxide A and B, chamazulene, and sesquiterpenes; and other compounds like tannins, anthemic acid, choline, polysaccharides, and phytoestrogens.[17]  apigenin	Anti-Inflammatory: chamazulene and bisabolol, can help lessen the swelling and redness that come with acne lesions. Antibacterial- Propionibacterium acnes and other acne-causing bacteria can be inhibited from growing by the inherent antibacterial qualities of chamomile essential oils. Antioxidant -shielding the skin from oxidative stress, which can worsen skin irritation and cause acne.[18]

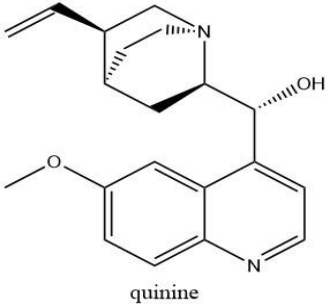
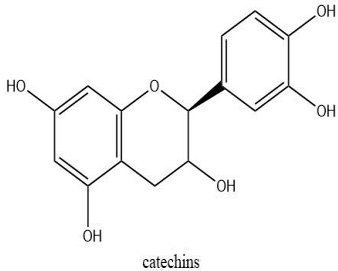
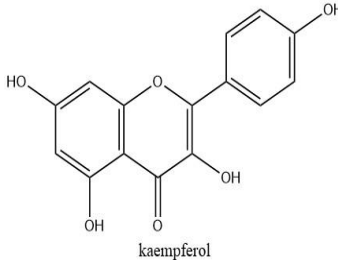
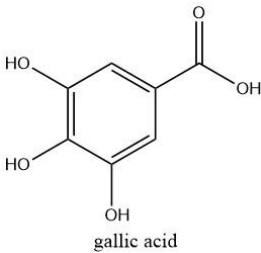
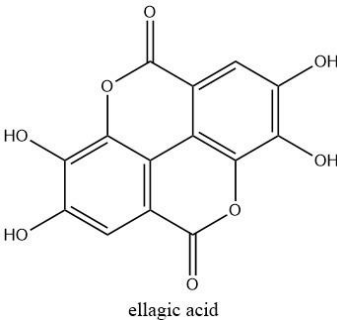
8	Name: Common marigold Synonym: Pot marie gold Family: Asteraceae Biological source: The dried petals or extracts of <i>Calendula officinalis</i> are commonly used in skincare products.  Fig 8: Common marigold	volatile oil, quinine, flavonoids, triterpenoids, glycosides, saponins, carotenoids, and steroids.[19]  quinine	Anti Acne-By lowering microorganisms on the skin and avoiding infections, its antibacterial qualities can aid in the treatment of acne. Anti-inflammatory Properties _Due to its ability to reduce irritation and inflammation, calendula is beneficial for treating skin disorders such as psoriasis, dermatitis, and eczema. Wound Healing-By encouraging tissue regeneration, the flower's extracts are known to aid in the healing of wounds. For mild burns, abrasions, and wounds, this can be helpful. Anti-aging-may protect the skin against damage brought on by free radicals, which can speed up the ageing process. It might make fine lines and wrinkles less noticeable.[20]
9	Name: Witch Hazel. Synonym: American Witch Hazel. Family: Hamamelidaceae Biological source: The bark, twigs, and leaves of the plant are the primary parts used to produce witch hazel extract of <i>Hamamelis virginiana</i>.	tannins, notably gallotannins, and to a lesser extent flavonoids, such as procyanidins, catechins, and flavenols. These components vary according on the region.[21]	Anti-Inflammatory can help calm skin disorders including eczema, psoriasis, and sunburn while also relieving irritation and redness. Antioxidant-The plant's tannins and flavonoids, which also function as antioxidants, help shield the skin from harm from environmental stressors and free radicals. Anti Acne-antibacterial qualities can help cleanse the skin, reduce germs that cause acne, and stop fresh outbreaks.[22]

	 Fig 9: Witch Hazel.	 catechins	
10	Name: Malabar plum Synonym: jambolan, jambol, or black plum, Jamun or IndianBlueberry Family: Myrtaceae Biological source: The fruits, seeds, and sometimes the leaves of syzygium cumini.  Fig10: Malabar plum	Polyphenols, flavonoids, gallic acids, anthocyanins, tannins, phenols, alkaloids, ellagic acid, glycoside, isoquercetin, kaempferol, myricetin, tannins, flavonols, flavone, and vitamins are the primary components. [23]  kaempferol	Anti Acne-antibacterial qualities can aid in both the prevention and management of acne. Acne is frequently caused by excessive oil production, which is lessened by the fruit's astringent properties. Anti-Aging-like vitamin C and polyphenols, which are abundant in jamun, aid in the fight against free radicals. This can help to promote a young complexion by lessening the visibility of fine lines and wrinkles. Skin Brightening-The vitamin C in jamun can help make pigmentation and dark spots lighter, giving the skin a more even and brighter tone.
11	Name: Neem tree Synonym:.,Neem tree Indian lilac Margosa tree Family: Meliaceae Biological source: The biological source of neem is the plant <i>Azadirachta indica</i>	Major phytochemicals found in neem include gallic acid, glycoproteins, triterpenes, limonoids, flavonoids, phenols, tannins, nimbins, saponins, and catechins.[24]	DiminishedHyperpigmentation-Bioactive substances with anti-inflammatory and antioxidant qualities, such as nimbin, nimbidin, and azadirachtin, are found in neem. By blocking the synthesis of melanin, the pigment that determines skin tone. Anti-Inflammatory Characteristics-The anti-inflammatory qualities

	A. Juss., commonly known as neem.  Fig 11: Neem tree	 gallic acid	of neem can relieve inflamed skin and lessen redness.[25] <u>Antifungal And Antibacterial Properties-</u> Strong antibacterial and antifungal qualities of neem can aid in the treatment of acne and the avoidance of infections
12	Name: Tea plant Synonym: Tea plant Tea tree Family; Theaceae Biological source The biological source of green tea is the leaves and buds of the plant <i>Camellia sinensis</i> (L.) Kuntze.  Fig 12: Tea plant	The primary chemical components of tea include eight catechins, caffeine, theaflavine, gallic acid, chlorogenic acid, ellagic acid, and kaempferol-3-G. [26]  ellagic acid	<u>Reduced Inflammation Impact-</u> Reducing inflammation can help avoid or minimise pigmentation since it can occasionally result in post-inflammatory hyperpigmentation (PIH). <u>Defence Against UV:</u> Green tea can supplement sun protection measures, however it should not be used in place of sunscreen.

CONCLUSION

Medicinal plants offer a promising and natural alternative for the treatment and management of various dermatological conditions due to their rich reservoir of bioactive compounds and comparatively low risk of adverse effects. Traditional herbs such as aloe vera, sandalwood, chamomile, Alexandrian laurel, ginseng, and neem, among others, have demonstrated significant anti-inflammatory, antioxidant, antimicrobial,

and wound-healing properties. These effects are largely attributed to key phytochemicals like flavonoids, terpenes, and polyphenols, which contribute to skin protection, regeneration, and overall health. While their traditional use is well-documented, understanding the molecular mechanisms behind their therapeutic actions highlights the need for more rigorous clinical studies to validate their safety and efficacy. Integrating medicinal plants into modern dermatological

treatments holds great potential as either standalone remedies or complementary therapies to conventional skin care approaches.

REFERENCES

1. Fenner J, Clark RA. Anatomy, physiology, histology, and immunohistochemistry of human skin. *Skin tissue engineering and regenerative medicine*. 2016 Jan 14;1:83-103.
2. Liyanage A, Liyanage G, Sirimanna G, Schürer N. Comparative Study on Depigmenting Agents in Skin of Color. *J Clin Aesthet Dermatol*. 2022 Feb;15(2):12-17. PMID: 35309879; PMCID: PMC8884189.
3. Addor FAS. Antioxidants in dermatology. *An Bras Dermatol*. 2017 May-Jun;92(3):356-362. doi: 10.1590/abd1806-4841.20175697. PMID: 29186248; PMCID: PMC5514576.
4. Parisa Ghasemiyeh, Soliman Mohammadi-Samani, Kiarash Noorizadeh, Ouriel Zadmehr, Shiva Rasekh, Shiva Mohammadi-Samani, Dorsa Dehghan, Novel topical drug delivery systems in acne management: Molecular mechanisms and role of targeted delivery systems for better therapeutic outcomes, *Journal of Drug Delivery Science and Technology*, Volume 74, 2022, 103595, ISSN 1773-2247.
5. Cassien M, Mercier A, Thétiot-Laurent S, Culcasi M, Ricquebourg E, Asteian A, Herbertte G, Bianchini JP, Raharivelomanana P, Pietri S. Improving the Antioxidant Properties of *Calophyllum inophyllum* Seed Oil from French Polynesia: Development and Biological Applications of Resinous Ethanol-Soluble Extracts. *Antioxidants (Basel)*. 2021 Jan 30;10(2):199. doi: 10.3390/antiox10020199. PMID: 33573143; PMCID: PMC7910904.
6. Periyasamy, Saravanan & Jaikumar, K. & Mohamed, M. & Anand, Divyanshu. (2015). Phytochemical analysis of bioactive compounds from *Calophyllum inophyllum* L., leaf extract using GC-MS analysis. 7. 956-959.
7. Saleem S, Muhammad G, Hussain MA, Altaf M, Bukhari SNA. *Withania somnifera* L.: Insights into the phytochemical profile, therapeutic potential, clinical trials, and future prospective. *Iran J Basic Med Sci*. 2020 Dec;23(12):1501-1526. doi: 10.22038/IJBMS.2020.44254.10378. PMID: 33489024; PMCID: PMC7811807.
8. Narra K, Naik SK, Ghatge AS. A Study of Efficacy and Safety of Ashwagandha (*Withania somnifera*) Lotion on Facial Skin in Photoaged Healthy Adults. *Cureus*. 2023 Mar 15;15(3):e36168. doi: 10.7759/cureus.36168. PMID: 36937128; PMCID: PMC10017910.
9. Ung, Le. (2018). Phytoconstituents and Biological Activities of *Panax vietnamensis* (Vietnamese Ginseng): A Precious Ginseng and Call for Further Research-A systematic review. *Natural product communications*. 13. 1381-1384.
10. Meng H, Liu XK, Li JR, Bao TY, Yi F. Bibliometric analysis of the effects of ginseng on skin. *J Cosmet Dermatol*. 2022 Jan;21(1):99-107.

- doi: 10.1111/jocd.14450. Epub 2021 Sep 14. PMID: 34520601.
11. kandasamy A, Aruchamy K, Rangasamy P, Varadhaiyan D, Gowri C, Oh TH, Ramasundaram S, Athinarayanan B. Phytochemical Analysis and Antioxidant Activity of Centella Asiatica Extracts: An Experimental and Theoretical Investigation of Flavonoids. *Plants* (Basel). 2023 Oct 12;12(20):3547. doi: 10.3390/plants12203547. PMID: 37896010; PMCID: PMC10610425.
 12. Ratz-Lyko A, Arct J, Pytkowska K. Moisturizing and Antiinflammatory Properties of Cosmetic Formulations Containing Centella asiatica Extract. *Indian J Pharm Sci*. 2016 Jan-Feb;78(1):27-33. doi: 10.4103/0250-474x.180247. PMID: 27168678; PMCID: PMC4852572.
 13. Batiha GE, Wasef L, Teibo JO, Shaheen HM, Zakariya AM, Akinfe OA, Teibo TKA, Al-Kuraishy HM, Al-Garbee AI, Alexiou A, Papadakis M. Commiphora myrrh: a phytochemical and pharmacological update. *Naunyn Schmiedebergs Arch Pharmacol*. 2023 Mar;396(3):405-420. doi: 10.1007/s00210-022-02325-0. Epub 2022 Nov 18. PMID: 36399185; PMCID: PMC9672555.
 14. Alraddadi, B.G.; Shin, H.-J. Biochemical Properties and Cosmetic Uses of Commiphora myrrha and Boswellia serrata. *Cosmetics* 2022, 9, 119.
 15. Khalid A, Hameed A, Tahir MF. Wheat quality: A review on chemical composition, nutritional attributes, grain anatomy, types, classification, and function of seed storage proteins in bread making quality. *Front Nutr*. 2023 Feb 24;10:1053196. doi: 10.3389/fnut.2023.1053196. PMID: 36908903; PMCID: PMC9998918.
 16. Park SH, Park J, Lee M, Jun W, Kim J, Geum J, Kim OK, Lee J. Wheat Ceramide Powder Mitigates Ultraviolet B-Induced Oxidative Stress and Photoaging by Inhibiting Collagen Proteolysis and Promoting Collagen Synthesis in Hairless Mice. *Prev Nutr Food Sci*. 2023 Dec 31;28(4):418-426. doi: 10.3746/pnf.2023.28.4.418. PMID: 38188085; PMCID: PMC10764234.
 17. Lairikyengbam D, Wetterauer B, Schmiech M, Jahraus B, Kirchgessner H, Wetterauer P, Berschneider K, Beier V, Niesler B, Balta E, Samstag Y. Comparative analysis of whole plant, flower and root extracts of Chamomilla recutita L. and characteristic pure compounds reveals differential anti-inflammatory effects on human T cells. *Front Immunol*. 2024 Apr 24;15:1388962. doi: 10.3389/fimmu.2024.1388962. PMID: 38720895; PMCID: PMC11077421.
 18. Park SH, Park J, Lee M, Jun W, Kim J, Geum J, Kim OK, Lee J. Wheat Ceramide Powder Mitigates Ultraviolet B-Induced Oxidative Stress and Photoaging by Inhibiting Collagen Proteolysis and Promoting Collagen Synthesis in Hairless Mice. *Prev Nutr Food Sci*. 2023 Dec 31;28(4):418-426. doi: 10.3746/pnf.2023.28.4.418. PMID: 38188085; PMCID: PMC10764234.
 19. Shahane K, Kshirsagar M, Tambe S, Jain D, Rout S, Ferreira MKM, Mali S, Amin P, Srivastav PP, Cruz

ARTICLE ID: BTS0326008

- J, Lima RR. An Updated Review on the Multifaceted Therapeutic Potential of *Calendula officinalis* L. Pharmaceuticals (Basel). 2023 Apr 18;16(4):611. doi: 10.3390/ph16040611. PMID: 37111369; PMCID: PMC10142266.
20. Kang CH, Rhie SJ, Kim YC. Antioxidant and Skin Anti-Aging Effects of Marigold Methanol Extract. Toxicol Res. 2018 Jan;34(1):31-39. doi: 10.5487/TR.2018.34.1.031. Epub 2018 Jan 15. PMID: 29371999; PMCID: PMC5776915.
 21. Trüeb RM. North American Virginian Witch Hazel (*Hamamelis virginiana*): Based Scalp Care and Protection for Sensitive Scalp, Red Scalp, and Scalp Burn-Out. Int J Trichology. 2014 Jul;6(3):100-3. doi: 10.4103/0974-7753.139079. PMID: 25210333; PMCID: PMC4158622.
 22. Piazza S, Martinelli G, Vrhovsek U, Masuero D, Fumagalli M, Magnavacca A, Pozzoli C, Canilli L, Terno M, Angarano M, Dell'Agli M, Sangiovanni E. Anti-Inflammatory and Anti-Acne Effects of *Hamamelis virginiana* Bark in Human Keratinocytes. Antioxidants (Basel). 2022 Jun 5;11(6):1119. doi: 10.3390/antiox11061119. PMID: 35740016; PMCID: PMC9220085.
 23. Rizvi MK, Rabail R, Munir S, Inam-Ur-Raheem M, Qayyum MMN, Kieliszek M, Hassoun A, Aadil RM. Astounding Health Benefits of Jamun (*Syzygium cumini*) toward Metabolic Syndrome. Molecules. 2022 Oct 24;27(21):7184. doi: 10.3390/molecules27217184. PMID: 36364010; PMCID: PMC9654918.
 24. Franco P, Rampino M, Ostellino O, Schena M, Pecorari G, Garzino Demo P, Fasolis M, Arcadipane F, Martini S, Cavallin C, Airolidi M, Ricardi U. Management of acute skin toxicity with *Hypericum perforatum* and neem oil during platinum-based concurrent chemoradiation in head and neck cancer patients. Med Oncol. 2017 Feb;34(2):30. doi: 10.1007/s12032-017-0886-5. Epub 2017 Jan 18. PMID: 28101834.
 25. Subapriya R, Nagini S. Medicinal properties of neem leaves: a review. Curr Med Chem Anticancer Agents. 2005 Mar;5(2):149-6. doi: 10.2174/1568011053174828. PMID: 15777222
 26. Roh E, Kim JE, Kwon JY, Park JS, Bode AM, Dong Z, Lee KW. Molecular mechanisms of green tea polyphenols with protective effects against skin photoaging. Crit Rev Food Sci Nutr. 2017 May 24;57(8):1631-1637. doi: 10.1080/10408398.2014.1003365. PMID: 26114360.