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Pomegranate (*Punica granatum*): a comprehensive review of its medicinal properties and traditional uses and prospect in wellness industry: A Review

Delima (*Punica granatum*): tinjauan komprehensif tentang sifat terapeutik, penggunaan tradisional, dan prospek dalam industri kesehatan holistik: Suatu Kajian Pustaka

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ABSTRACT

Pomegranate (*Punica granatum*) is a fruit-bearing shrub with a rich history of traditional use in various medicinal systems. This review aims to provide a comprehensive analysis of the botanical profile, medicinal properties, and traditional uses of pomegranate. Pomegranate exhibits a wide range of medicinal properties, including antioxidant, anti-inflammatory, antimicrobial, and anticancer properties. Its antioxidant and anti-inflammatory properties contribute to its cardioprotective effects, reducing oxidative stress, inflammation, and lipid peroxidation. Pomegranate has also shown promise in dermatological applications, including wound healing, antimicrobial, and anti-inflammatory effects. Pomegranate has been used in traditional medicine systems for centuries, with its prominence documented in numerous ancient texts. Its anxiolytic and anti-inflammatory properties make it a valuable ingredient in spa and wellness services. The fruit's bioactive compounds, including polyphenols and flavonoids, contribute to its potential as a cosmeceutical and skincare ingredient. Pomegranate is a remarkable fruit with a wide range of medicinal properties and applications. Its traditional uses and modern scientific research highlight its potential as a valuable resource in the field of natural medicine. Future studies can focus on elucidating the mechanisms of action underlying its various medicinal properties and identifying specific bioactive compounds responsible for its therapeutic effects.

Keywords: pomegranate, Punica granatum, traditional use, medicinal properties, wellness industry

INTISARI

Delima (*Punica granatum*) adalah tumbuhan semak berbuah yang memiliki sejarah panjang dalam berbagai sistem pengobatan tradisional. Tinjauan ini bertujuan menganalisis secara komprehensif profil botani, sifat obat, dan penggunaan delima secara tradisional. Delima memiliki berbagai sifat obat yang luar biasa, termasuk antioksidan, antiinflamasi, antimikroba, dan antikanker. Sifat antioksidan dan antiinflamasi berkontribusi pada efek kardioprotektifnya, mengurangi stres oksidatif, peradangan, dan peroksidasi lipida. Delima juga ampuh digunakan dalam bidang dermatologi; membantu penyembuhan luka serta mempunyai efek antimikroba dan antiinflamasi. Delima telah digunakan dalam sistem pengobatan tradisional selama berabad-abad, yang didokumentasi dengan baik dalam berbagai arsip pengobatan kuno. Sifat ansiolitik dan antiinflamasinya menjadi andalan dalam industri spa dan kesehatan. Senyawa bioaktifnya, termasuk polifenol dan flavonoid, menjadi potensi buah ini sebagai bahan baku kosmetik dan perawatan kulit. Delima adalah sumberdaya yang sangat berharga dalam pengobatan holistik yang telah dibuktikan secara tradisional maupun dalam penelitian ilmiah modern. Penelitian di

masa depan dapat difokuskan pada mekanisme kerja yang mendasari berbagai sifat obatnya dan mengidentifikasi senyawa bioaktif spesifik yang bertanggung jawab terhadap efek terapeutiknya.

Kata kunci: delima, Punica granatum, penggunaan tradisional, sifat terapeutik, industri kesehatan holistik

INTRODUCTION

Pomegranate (*Punica granatum*) is a fruit-bearing shrub that has been widely utilized in traditional medicine systems for centuries. Its rich history of medicinal use is documented in various ancient texts and manuscripts, including the esteemed Usadha Taru Pramana, a Balinese medicinal palm manuscript. This review paper aims to provide a comprehensive analysis of the botanical profile, medicinal properties, and traditional uses of pomegranate. Furthermore, it explores its significance in diverse traditional medicine systems such as Ayurveda, Chinese medicine, American tribal medicine, and The Holy Quran. By examining the active compounds, therapeutic potential, regional variations, cultivation practices, culinary applications, and its emerging role in the wellness industry, this review sheds light on the multifaceted nature of *pomegranate as a valuable medicinal plant*.

POMEGRANATE IN ANCIENT TEXTS AND TRADITIONAL MEDICINE SYSTEMS

Pomegranate's prominence in traditional medicine has been mentioned in numerous ancient texts from different cultures.

Usadha Taru Pramana Manuscript

The Usadha Taru Pramana manuscript holds a significant place in Balinese traditional medicine. It is a palm manuscript that contains valuable knowledge about 168 medicinal plants and their applications in treating various ailments (Ciawi & Swantara, 2006). The manuscript's name translates to "Healing Trees of Pramana" in English, reflecting its focus on plants and their healing properties. Within the Usadha Taru Pramana, pomegranate (*Punica granatum*) (fruit, leaf, bark, stem and root) is highlighted as one of the important medicinal plants used in Balinese traditional medicine for addressing stomach-related issues (Ciawi & Swantara, 2006).

Ayurveda

In Ayurveda, an ancient Indian healing system, pomegranate is referred to as "Dalim" and has been recognized for its medicinal properties. Its various parts, including the fruit, seeds, peel, and juice, are utilized for their therapeutic properties. Pomegranate is believed to possess cooling and nourishing qualities, making it beneficial for balancing the doshas (bioenergetic principles) in Ayurvedic medicine. It is used to treat digestive disorders, boost immunity, support cardiovascular health, and promote overall well-being (Ge et al., 2021).

Chinese Medicine

Chinese medicine texts, such as the "Shennong Ben Cao Jing," describe pomegranate as a valuable herb with therapeutic effects. Pomegranate has a long history of use in Chinese medicine, where it is known as "Shi Liu." In this system, pomegranate is associated with properties such as astringency and cooling nature. It is used to address conditions related to excessive heat, such as sore throat, diarrhea, and skin inflammations. Pomegranate is also valued for its

ability to tonify the blood and nourish the body, making it useful for conditions such as anemia and menstrual disorders (Ge et al., 2021).

American Tribal Medicine

Pomegranate holds significance in American Indian medicine as well. It is revered for its various medicinal properties and is used to address a wide range of health concerns. In American Indian traditions, pomegranate is often associated with promoting vitality, strengthening the immune system, and supporting overall health. Its high antioxidant content and anti-inflammatory properties make it a valuable addition to traditional remedies for different ailments (Seeram, 2008).

The Holy Quran

Pomegranate was stated as *al-rumman* in The Holy Qur'an in QS. Al-An'am [6]: 99 that the stem also has medicinal properties like other parts of the plant (Prastyo et al., 2021). Pomegranate was mentioned as able to clean the stomach in Al-Qur'an, in surah Ar-Rahman verse 68 "in the two heaven there are two fruits, kurma and pomegranate." Pomegranate, together with olive, is stated two more times in Al-Qur'an in surah Al-An'am verse 99 and verse 141 (Diniasti, 2021).

Other Traditional Medicine Systems

Apart from Ayurveda, Chinese medicine, and American Indian medicine, pomegranate is utilized in several other traditional medicine systems across the globe. Traditional healers and practitioners recognize its potential in promoting health and treating various conditions. The extensive use of pomegranate in these diverse traditional medicine systems (Buddhism, Judaism, Zoroastrian rituals, Persian mythology, Greek mythology, Turin papyrus, and many more) further underscores its significance as a valuable medicinal plant (Chassagne, 2022).

BOTANICAL PROFILE OF POMEGRANATE

Origin and Distribution

Pomegranate (*Punica granatum*) is believed to have originated in the region encompassing modern-day Iran and northern India (Bassiri-Jahromi, 2018; Zuhair Dardona, 2023). From its place of origin, it spread to various parts of the world, including the Mediterranean region, Central Asia, and the Middle East. Today, pomegranate is cultivated in numerous countries with suitable climatic conditions, such as India, Iran, Turkey, Spain, and the United States (Bassiri-Jahromi, 2018; Zuhair Dardona, 2023).

Taxonomy and Classification

Pomegranate belongs to the family Lythraceae and is classified under the genus *Punica*, the order is Myrtales, Subclass Rosidae, Class Magnoliopsida, Division Magnoliophyte, Kingdom Plantae (Vijayreddy, 2024). It is a perennial fruit-bearing shrub that can reach a height of 5 to 8 meters. The plant features glossy, lance-shaped leaves and produces vibrant orange-red flowers. The flowers give rise to the distinctive spherical fruit with a tough, leathery rind enclosing numerous juicy arils (Yuan et al., 2018).

Morphology and Growth Characteristics

Pomegranate (*Punica granatum*) is a deciduous shrub or small tree that can grow between 5 to 10 meters in height, exhibiting a dense, bushy habit with

multiple trunks and slender, spiny branches. The leaves are simple, oblong to lanceolate, glossy dark green above, paler underneath, and arranged oppositely or sub-oppositely along the branches. Its striking, bisexual flowers, 3 to 4 centimeters in diameter, are bright red to orange-red with a tubular calyx and crumpled petals, attracting pollinators such as bees and butterflies. The spherical fruit, classified as a berry, measures 5 to 12 centimeters in diameter, with a thick, leathery rind that ranges from yellowish-green to deep red or purplish. Inside, the fruit is divided by membranous walls and filled with numerous arils, each containing a seed enveloped in a juicy sac (Coronado-Reyes et al., 2021). Pomegranate has a deep, extensive root system that allows it to tolerate drought conditions and a variety of soil types, though it thrives best in well-drained, slightly acidic to neutral soils. Adapted to Mediterranean climates with hot, dry summers and cool winters, the plant requires full sunlight for optimal growth and benefits from regular watering during the fruiting period (Kumar et al., 2020; Tinebra et al., 2021). While capable of self-pollination, cross-pollination by insects can enhance fruit set and quality, underscoring the plant's adaptability and resilience, which contribute to its potential in the wellness industry for its medicinal properties and nutritional benefits (Jambagi, 2022).

Regional Variations and Cultivation

The composition of pomegranate fruits can vary significantly based on the geographical location, climate, soil conditions, and cultivation practices. These variations can affect the *flavour*, *colour*, *size*, and *nutrient content* of the fruit. Studies have shown that differences in climatic conditions and soil characteristics can lead to variations in the phenolic compounds, antioxidants, and overall quality of pomegranate fruit (Coronado-Reyes et al., 2021). For example; there are 3 varieties of pomegranate fruits in Indonesia, white, red and black/purple pomegranate (Chasanah, 2021), the red one is sweet and fresh, the purple/black one is sweeter than the red one, and the white one is more chewy, coarse, and not as sweet as the red one, and 60 varieties of pomegranates in Afghanistan (Melgarejo et al., 2012). There are over 500 known cultivars of pomegranate worldwide. These cultivars vary in characteristics such as fruit size, *colour*, taste, and ripening time (Holland et al., 2009; Kandyliis & Kokkinomagoulos, 2020). Pomegranates grown in arid regions like Iran or India often have higher levels of antioxidants, such as punicalagins, due to stress conditions that stimulate polyphenol production. In contrast, fruits from more temperate climates may have lower antioxidant concentrations (Sharma et al., 2022; Zhang et al., 2023).

Specific cultivation practices, such as organic farming, can enhance the fruit's medicinal properties by avoiding synthetic pesticides and fertilizers, which may otherwise reduce the levels of beneficial compounds (Andreu-Coll et al., 2023). Additionally, irrigation techniques such as deficit irrigation (controlled water supply) can increase phenolic content and improve antioxidant capacity (Galindo et al., 2018). These practices not only contribute to the fruit's nutritional and therapeutic quality but also enhance its overall efficacy in disease prevention. For example, pomegranates cultivated with traditional, sustainable methods in Mediterranean regions are often richer in flavonoids, further boosting their health benefits (Almutairi et al., 2021).

PHARMACOLOGICAL STUDIES AND CLINICAL TRIALS

Pomegranate's medicinal properties are attributed to its diverse chemical composition, including polyphenols, flavonoids, tannins, anthocyanins,

ellagitannins, and alkaloids. Key compounds like punicalagins, ellagic acid, punicalins, and punicic acid contribute to its health benefits (Khadivi et al., 2024). These bioactive compounds provide antioxidant, anti-inflammatory, antimicrobial, anticancer, and cardiovascular-protective effects (Bassiri-Jahromi, 2018; Zamanian et al., 2023). The antioxidant properties, particularly strong in the peel, help neutralize free radicals, reducing oxidative stress (Zamanian et al., 2023). Anti-inflammatory effects from compounds such as punicic acid may lower the risk of chronic diseases. Pomegranate extracts show antimicrobial activity against various pathogens. Additionally, its potential anticancer properties include inhibiting cancer cell growth and inducing apoptosis (Moga et al., 2021). Cardiovascular benefits include improved heart health, reduced blood pressure, and better lipid profiles. Lastly, the fruit's tannins and fiber enhance digestive health by supporting beneficial gut flora. Regular consumption of pomegranate offers a range of health benefits, reinforcing its pharmacological significance (Fahmy et al., 2020; Rizzo et al., 2023).

Extraction Methods and Identification of Active Components

To harness the medicinal benefits of pomegranate, various extraction methods are employed to obtain bioactive compounds from different parts of the plant. Common extraction techniques include solvent extraction, maceration, and Soxhlet extraction (Cano-Lamadrid et al., 2022). These methods allow for the isolation of specific active components from pomegranate, ensuring their concentration and purity for further analysis and therapeutic applications (Sharma et al., 2022).

Numerous studies have focused on identifying the active components present in pomegranate extracts. Techniques such as chromatography, mass spectrometry, and nuclear magnetic resonance (NMR) spectroscopy are employed to isolate and identify the bioactive compounds (Tang & Hatzakis, 2020). This identification process helps in understanding the chemical composition of pomegranate and its potential mechanisms of action in various therapeutic applications.

The ethanolic extracts of pomegranate peel and seeds contain 12.4 and 13.4 times higher total flavonoids, respectively, compared to the juice extract (Derakhshan et al., 2018). Pomegranate juice itself contains over 40 bioactive compounds, with major phytochemicals including gallic acid (43.25%), quercetin (10%), 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- (6.07%), furfural (4.6%), oleic acid (4.45%), D-allose (3.56%), gamma-sitosterol (3.52%), thiamine (3.17%), ascorbic acid (3.16%), and pyrogallol (2.25%) (Almiah & Jum'a, 2017). GC-MS analysis of the ethanol extract from pomegranate bark has identified pyrrolidine, hydroxycholecalciferol (calcifediol and/or alfacalcidiol), decaborane, and morpholine (Prastyo et al., 2021). Furthermore, the leaf extract has shown that dodecanyl acrylic acid ester, palmitic acid, stearic acid, 9-octadecenamide, and dioctyl hexadioic acid ester are potent antimicrobials against *Micrococcus luteus* and *Escherichia coli* (Ciawi & Swantara, 2006).

Ethanol is often considered the best solvent for extraction due to its ability to dissolve both polar and non-polar compounds. However, for safe and consumable extracts rich in hydrophilic compounds, water is preferred. The methanolic extract of pomegranate flowers contains pelargonidin-3,5-glucoside, an anthocyanin associated with antidiabetic activity (Gościniak et al., 2022). Hydrolyzable tannins, the primary polyphenolics in pomegranate juice, include ellagitannins, gallotannins, gallagyl esters, hydroxycinnamic acids, and

hydroxybenzoic acids (Vučić et al., 2019). The methanolic extract of pomegranate juice predominantly contains fructose, glucose, citric acid, catechin (a flavonoid), gallic acid (a phenolic acid), ethyl acetate, and 3-octanone (a volatile organic compound) (Mphahlele et al., 2016).

Antioxidant and Anti-inflammatory Properties

Pomegranate is well-known for its potent antioxidant properties, attributed to its high content of polyphenols such as punicalagins and ellagic acid (Lansky and Newman, 2007). These compounds exhibit strong free radical scavenging activity and protect cells against oxidative damage. Additionally, pomegranate displays significant anti-inflammatory effects by inhibiting pro-inflammatory mediators like cytokines and enzymes (Danesi & Ferguson, 2017), therefore a promising agents to target the SARS CoV-2 virus (Alexova et al., 2023), reduce muscle damage (Canals-Garzón et al., 2022).

Anti-microbial and Anti-fungal Activities

Studies have demonstrated the broad-spectrum anti-microbial activity of pomegranate extracts against various bacteria, including both Gram-positive and Gram-negative strains (Ciawi & Swantara, 2006). In *in vitro* studies found that the peel of this fruit are active against *Candida albicans* (Celiksoy et al., 2022). The presence of bioactive compounds like tannins and flavonoids contributes to its antimicrobial effects. Pomegranate has also shown antifungal activity against several pathogenic fungi, making it a potential natural alternative for combating fungal infections (Jayan et al., 2020), extract of leaves contain antibacterial against *Micrococcus luteus* and *Escherichia coli* (Ciawi & Swantara, 2006).

Anti-cancer Potential

Pomegranate exhibits promising anti-cancer properties due to its ability to inhibit cancer cell proliferation and induce apoptosis (Moga et al., 2021). The polyphenols in pomegranate, particularly ellagic acid and punicalagins, have been shown to suppress tumor growth and angiogenesis, as well as prevent metastasis. These effects have been observed in various types of cancer, including breast, prostate, colon, and lung cancers (Moga et al., 2021).

Cardiovascular Health Benefits

Regular consumption of pomegranate or its juice has been associated with numerous cardiovascular health benefits. Pomegranate's antioxidant and anti-inflammatory properties contribute to its cardioprotective effects reducing oxidative stress, inflammation, and lipid peroxidation (Delgado et al., 2020). Pomegranate juice consumption has shown positive effects on lipid profiles, blood pressure regulation, and endothelial function, which are important factors in maintaining cardiovascular health (Zuraini et al., 2021).

Dermatological Applications

Pomegranate extracts and oil have gained attention for their dermatological applications. Due to its antioxidant and anti-inflammatory properties, pomegranate exhibits potential benefits for various skin conditions, including acne, eczema, and psoriasis (Sarikurkcu et al., 2016). It aids in reducing inflammation, promoting wound healing, and protecting against UV-induced damage. Pomegranate extracts are also utilized in cosmetic formulations for their anti-aging effects, improving skin texture, and enhancing overall skin health (Afaq et al., 2005).

Other Potential Medicinal Properties

In addition to the aforementioned properties, pomegranate has shown promise in various other areas of medicinal research. Preliminary studies suggest potential benefits in the management of diabetes, neurodegenerative disorders, gastrointestinal health, and immune modulation (Basu et al., 2009; Jurenka, 2008), antidiarrheal (Rahayuningsih et al., 2021). However, further research is needed to fully understand and harness the therapeutic potential of pomegranate in these areas. Table 1 presents some researches that has been done in Indonesia and abroad on fruit, peel, leaf, bark, stem, and seed of *Punica granatum*.

Table 1. Researches on medicinal properties of several parts of *Punica granatum*

Plant parts	Properties/ ingredients	Test organism involved	Additional information	References
fruit juice	antibacterial	<i>Streptococcus mutans</i>	plaque and caries in teeth	(Kholisa et al., 2018)
fruit juice	alleviate heavy metal induced oxidative stress	lead treated rats	kidney, liver, heart and testis	(Aksu et al., 2017)
fruit juice	antibacterial	<i>Treponema denticola</i>	dentistry	(Suhaim, 2017)
fruit peel	anti diarrheal	<i>Salmonella typhimurium</i>	ethyl acetate extract	(Chassagne, 2022)
fruit peel	antibacterial	<i>Escherichia coli</i>	<i>in vitro</i>	(Novitri & Kurniati, 2021)
fruit peel	antifungal	<i>Candida albicans</i>	<i>in vitro</i>	(Brighenti et al., 2021)
fruit peel	antidiarrheal	Swiss Webster male mice	oleum ricini method	(Rahayuningsih et al., 2021)
fruit peel	strong irritation	hen's egg	(HET-CAM) test	(Chasanah, 2021)
fruit peel	antimicrobial	<i>Candida albicans</i>	<i>in vitro</i>	(Celiksoy et al., 2022)
leaf	antimicrobial	<i>Micrococcus luteus</i> and <i>Escherichia coli</i>	ethyl acetate extract, <i>in vitro</i>	(Ciawi & Swantara, 2006)
leaf	ethanol extract hepatoprotective	mice	induced with paracetamol	(Sumyati. Yati, 2020)
leaf	antibacterial, ethanol extract	<i>Staphylococcus aureus</i> MRSA and <i>Escherichia coli</i> ESBL	<i>in vitro</i>	(Susilawati et al., 2020)
leaf	methanol extract	<i>Streptococcus mutans</i>	<i>in vitro</i>	(Akalili Sabrina & Probosari, 2015)
leaf	ethanol extract	<i>Escherichia coli</i>	<i>in vitro</i>	(Meta, 2019)
leaf	anti-cancer activity and anti-inflammatory	the human non-small cell lung carcinoma cell line A549 (ATCC CCL-185)	lung cancer	(Toda et al., 2020)
bark and root	diarrhea, inflammation, nose bleeding, sore throat, ulcer, and hoarseness.	Bacteria, fungus, virus, human	<i>in vitro</i>	(Maphetu et al., 2022)
flower of red pomegranate	antiseptic	<i>Streptococcus mutans</i>	<i>in vitro</i> , mouthrinse, 80% ethanol extract more potent than chlorhexidine gluconate 0.2%.	(Purnamasari, 2016)

flower	wound healing activities	<i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , and <i>Pseudomonas aeruginosa</i>	in combination with chamomile flower extract	(Niknam et al., 2021)
seed	alkaloid, antibacterial	<i>Streptococcus sanguis</i> ATCC 10556, mice	non-toxic to mice under 160mg/kg body weight	(Setiadhi et al., 2019)
seed oil	antioxidant, anti-inflammatory, antifibrotic, and antiangiogenic	wistar rats	prevent peritoneal adhesion	(Rakhshandeh et al., 2022)
seed oil	treating menopausal syndrome	patients with menopausal syndrome	individual cohort controlled study	(Huber et al., 2017)
40% peel extract	bacteriostatic	<i>Streptococcus mutans</i>	dentistry	(Putri K. et al., 2020)
peel extract	improve inflammatory status and oxidative stress biomarkers	diabetic type 2 patients	diabetes	(Grabež et al., 2022)
peel	antioxidant	none	ethanol extract	(Chasanah, 2021)
leaf extract	anti-inflammatory and anticancer	<i>Staphylococcus aureus</i> , <i>Bacillus subtilis</i> , <i>Salmonella typhi</i>	ethanol extract	(Kumar et al., 2015)

EXPLORING THE VERSATILITY OF DAILY USE, TOURISM, AND WELLNESS FOR DISEASE PREVENTION

Pomegranate Juice and Beverages

Pomegranate juice is a popular and widely consumed beverage known for its refreshing taste and potential health benefits. It can be consumed as a standalone drink or used as an ingredient in smoothies, cocktails, and mocktails. Pomegranate juice has been recognized for its high antioxidant content and potential anti-inflammatory properties, making it an appealing choice for health-conscious consumers (Fahmy et al., 2020). Its vibrant *colour* and tangy *flavour* contribute to its versatility in culinary applications.

Traditional Recipes and Culinary Uses

Pomegranate has a long history of being used in traditional recipes across various cuisines. Its unique sweet-tart flavour adds depth to both savory and sweet dishes. In Mediterranean and Middle Eastern cuisines, pomegranate molasses, made by reducing pomegranate juice, is a common ingredient used to enhance the flavour of salads, marinades, and stews. Pomegranate seeds are also used as a garnish in salads, desserts, and grain-based dishes, providing a pleasant crunch and burst of flavour (McNamara, 2024).

Potential in Spa and Wellness Services

Pomegranate's antioxidant and anti-inflammatory properties make it a valuable ingredient in the wellness industry. Its incorporation into spa treatments, such as massages, facials, and body wraps, is popular for promoting relaxation, rejuvenation, and overall well-being. The fruit's aromatic qualities and therapeutic benefits enhance the spa experience, offering a unique sensory journey for visitors. Pomegranate's rich polyphenol content helps in skin hydration, reducing inflammation, and combating signs of aging, making it a sought-after component in contemporary wellness products (Kandyliis &

Kokkinomagoulos, 2020; Kase et al., 2023; Niknam et al., 2021; Putri K et al., 2020).

Cosmetics, Skin Care, and Anti-aging Products

Pomegranate has been recognized for its beneficial effects on the skin. Its bioactive compounds, including polyphenols and flavonoids, contribute to its potential as a cosmetics and skincare ingredient, e.g. as lipbalm (Kase et al., 2023). Pomegranate extract and oil are commonly used in skincare products due to their moisturizing, nourishing, and anti-aging properties. These products help promote skin elasticity, reduce wrinkles and fine lines, and improve overall skin health (Kandylis & Kokkinomagoulos, 2020).

CONCLUSION AND FUTURE DIRECTIONS

Summary of Medicinal Properties

Pomegranate exhibits a wide range of medicinal properties that have been studied and recognized by various traditional medicine systems and modern scientific research. The fruit's antioxidant and anti-inflammatory properties contribute to its potential benefits in promoting overall health and well-being. Pomegranate also shows promise in areas such as antimicrobial activity, anti-cancer potential, cardiovascular health, dermatological applications, and more.

Opportunities for Further Research

Although considerable research has been conducted on pomegranate, there are still avenues for further exploration. Future studies can focus on elucidating the mechanisms of action underlying its various medicinal properties and identifying specific bioactive compounds responsible for its therapeutic effects. Additionally, investigating the optimal dosages and formulations of pomegranate extracts or active components can help in the development of standardized and effective therapeutic interventions.

Implications for Traditional and Alternative Medicine

Pomegranate's long-standing use in traditional medicine systems, such as Ayurveda, Chinese medicine, and American tribal medicine, highlights its potential as a valuable ingredient in traditional and alternative medicine practices. Its inclusion in these systems can enhance holistic approaches to healthcare and provide natural remedies for various ailments. Further exploration of pomegranate's integration into traditional medicine systems can bridge the gap between ancient wisdom and modern healthcare practices.

In conclusion, pomegranate is a remarkable fruit that offers a myriad of medicinal properties and applications. Its antioxidant, anti-inflammatory, antimicrobial, and potential anti-cancer effects, along with its benefits for cardiovascular health, dermatological applications, and more, make it a valuable resource in the field of natural medicine. Further research is needed to deepen our understanding of its mechanisms of action, identify active compounds, and explore its potential in various therapeutic interventions. Pomegranate holds great promise for traditional and alternative medicine systems, contributing to the well-being of individuals and opening new avenues for natural healthcare approaches that may be useful in the synthesis of therapeutic drugs and also suggest the herbal medicine. The therapeutic effect of this plant may be accounted for its counteracting action on free radicals *in vivo*.

REFERENCES

- Almiahy FH, Jum'a FF. 2017. GC-MS Analysis of Phytochemical Constituents in Ethanoic Extract of Pomegranate (*Punica granatum* L.) "Salami variety" grown in Iraq. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)* **10(10)**: 48–53. DOI: 10.9790/2380-1010034853
- Almutairi KF, Abdel-Sattar M, Mahdy AM, El-Mahrouky MA. 2021. Co-application of mineral and organic fertilizers under deficit irrigation improves the fruit quality of the Wonderful pomegranate. *PeerJ* **9**: e11328. DOI: 10.7717/peerj.11328
- Andreu-Coll L, Cano-Lamadrid M, Lipan L, López-Lluch D, Sendra E, Hernández F. 2023. Effects of Organic Farming on the Physicochemical, Functional, and Quality Properties of Pomegranate Fruit: A Review. *Agriculture* **13(6)**: 1167. DOI: 10.3390/agriculture13061167
- Bassiri-Jahromi S. 2018. *Punica granatum* (Pomegranate) activity in health promotion and cancer prevention. *Oncology Reviews*. DOI: 10.4081/oncol.2018.345
- Brighenti V, Iseppi R, Pinzi L, Mincuzzi A, Ippolito A, Messi P, Sanzani SM, Rastelli G, Pellati F. 2021. Antifungal Activity and DNA Topoisomerase Inhibition of Hydrolysable Tannins from *Punica granatum* L. *International Journal of Molecular Sciences* **22(8)**: 4175. DOI: 10.3390/ijms22084175
- Celiksoy V, Moses RL, Sloan AJ, Moseley R, Heard CM. 2022. Synergistic activity of pomegranate rind extract and Zn (II) against *Candida albicans* under planktonic and biofilm conditions, and a mechanistic insight based upon intracellular ROS induction. *Scientific Reports* **12(1)**: 19560. DOI: 10.1038/s41598-022-21995-7
- Ciawi Y, Swantara MD. 2006. Isolasi dan Identifikasi Zat Antibakteri dalam Daun Delima. *Prosiding Seminar Nasional Tahunan Persatuan Mikrobiologi Indonesia 2006*. paper presented at the PIT PERMI 2006. Solo
- Coronado-Reyes JA, Tinoco-Salazar J, Guisa-Morales ML, Cortés-Penagos CDJ, González-Hernández JC. 2021. Morphology about the varieties mexican pomegranate fruit (*Punica granatum*) and its ripening stage. *Food Science and Technology* **41(4)**: 993–999. DOI: 10.1590/fst.28620
- Derakhshan Z, Ferrante M, Tadi M, Ansari F, Heydari A, Hosseini MS, Conti GO, Sadrabad EK. 2018. Antioxidant activity and total phenolic content of ethanolic extract of pomegranate peels, juice and seeds. *Food and Chemical Toxicology* **114**: 108–111. DOI: 10.1016/j.fct.2018.02.023
- Fahmy H, Hegazi N, El-Shamy S, Farag MA. 2020. Pomegranate juice as a functional food: a comprehensive review of its polyphenols, therapeutic merits, and recent patents. *Food & Function* **11(7)**: 5768–5781. DOI: 10.1039/D0FO01251C
- Galindo A, Collado-González J, Griñán I, Corell M, Centeno A, Martín-Palomo MJ, Girón IF, Rodríguez P, Cruz ZN, Memmi H, Carbonell-Barrachina AA, Hernández F, Torrecillas A, Moriana A, Pérez-López D. 2018. Deficit irrigation and emerging fruit crops as a strategy to save water in Mediterranean semiarid agrosystems. *Agricultural Water Management* **202**: 311–324. DOI: 10.1016/j.agwat.2017.08.015
- Gościniak A, Bazan-Woźniak A, Pietrzak R, Cielecka-Piontek J. 2022. Pomegranate Flower Extract—The Health-Promoting Properties Optimized by Application of the Box–Behnken Design. *Molecules* **27(19)**: 6616. DOI: 10.3390/molecules27196616
- Holland D, Hatib K, Bar-Ya'akov I. 2009. Pomegranate: Botany, Horticulture, Breeding. In: Janick J (ed) *Horticultural Reviews*. Wiley, 127–191. DOI: 10.1002/9780470593776.ch2
- Jambagi SR. 2022. Pollination Biology of Pomegranate (*Punica granatum* L.) with special reference to Entomophily. *Insect Environment* **25(1)**. DOI: 10.55278/UESE6145
- Kandylis P, Kokkinomagoulos E. 2020. Food Applications and Potential Health Benefits of Pomegranate and its Derivatives. *Foods* **9(2)**: 122. DOI: 10.3390/foods9020122
- Kase MG, Prasetyaningsih A, Aditiyarini D. 2023. Antioxidant and Antibacterial Activity of Pomegranate Extract (*Punica granatum* L.) in Lip Balm Formulation. *Biology, Medicine, & Natural Product Chemistry* **12(1)**: 109–117. DOI: 10.14421/biomedich.2023.121.109-117
- Khadivi A, Rezaghali M, Shams M. 2024. Phytochemical properties and bioactive compounds of pomegranate (*Punica granatum* L.). *The Journal of Horticultural Science and Biotechnology* 1–14. DOI: 10.1080/14620316.2024.2371597
- Kumar NV, Godara A, Mirza A. 2020. Characteristics of Flowering and Fruiting Description of Pomegranate (*Punica granatum* L.). *International Journal of Current Microbiology and Applied Sciences* **9(11)**: 1–12. DOI: 10.20546/ijcmas.2020.911
- McNamara GR. 2024. *Turkish Tastes: A Culinary Reference Book on Türkiye's Amazing Ingredients*. Aegean Exporters' Associations: Alsancak, Izmir, Türkiye

- Moga MA, Dimienescu OG, Bălan A, Dima L, Toma SI, Bigiu NF, Blidaru A. 2021. Pharmacological and Therapeutic Properties of *Punica granatum* Phytochemicals: Possible Roles in Breast Cancer. *Molecules* **26**(4): 1054. DOI: 10.3390/molecules26041054
- Mphahlele RR, Fawole OA, Mokwena LM, Opara UL. 2016. Effect of extraction method on chemical, volatile composition and antioxidant properties of pomegranate juice. *South African Journal of Botany* **103**: 135–144. DOI: 10.1016/j.sajb.2015.09.015
- Niknam S, Tofighi Z, Faramarzi MA, Abdollahifar MA, Sajadi E, Dinarvand R, Toliyat T. 2021. Polyherbal combination for wound healing: *Matricaria chamomilla* L. and *Punica granatum* L. *DARU Journal of Pharmaceutical Sciences* **29**(1): 133–145. DOI: 10.1007/s40199-021-00392-x
- Prastyo B, Ma'arif AS, Pratiwi DW, Udaibah W, Abidin Z. 2021. Skrining Fitokimia Dan Analisis Gc-MS Dari Ekstrak Batang *Punica granatum* (Studi Ayat Mengenai Delima Dan Qs. Ali Imran [3]: 191). *Prosiding Konferensi Integrasi Interkoneksi Islam Dan Sains* **3**: 127–137
- Putri K N, Wahyuningtyas E, Saleh S. 2020. Pengaruh Pemberian Ekstrak Kulit Buah Delima (*Punica granatum* L.) Konsentrasi 10%, 20%, Dan 40% terhadap Pertumbuhan *Streptococcus mutans* Pada Plat Gigi Tiruan Resin Akrilik. undergraduate thesis, Yogyakarta, Universitas Gajah Mada
- Rizzo G, Pineda Chavez SE, Vandenkoornhuys E, Cárdenas Rincón CL, Cento V, Garlatti V, Wozny M, Sammarco G, Di Claudio A, Meanti L, Elangovan S, Romano A, Roda G, Loy L, Dal Buono A, Gabbiadini R, Lovisa S, Rusconi R, Repici A, Armuzzi A, Vetrano S. 2023. Pomegranate Extract Affects Gut Biofilm Forming Bacteria and Promotes Intestinal Mucosal Healing Regulating the Crosstalk between Epithelial Cells and Intestinal Fibroblasts. *Nutrients* **15**(7): 1771. DOI: 10.3390/nu15071771
- Sharma K, Kesharwani P, Prajapati SK, Jain A, Jain D, Mody N, Sharma S. 2022. An Insight into Anticancer Bioactives from *Punica granatum* (Pomegranate). *Anti-Cancer Agents in Medicinal Chemistry* **22**(4): 694–702. DOI: 10.2174/1871520621666210726143553
- Tinebra I, Scuderi D, Sortino G, Mazzaglia A, Farina V. 2021. Pomegranate Cultivation in Mediterranean Climate: Plant Adaptation and Fruit Quality of 'Mollar de Elche' and 'Wonderful' Cultivars. *Agronomy* **11**(1): 156. DOI: 10.3390/agronomy11010156
- Vijayreddy D. 2024. Pomegranate. *Minor Fruit Crops An Inclusive Study*. Walnut Publication: Bhubaneswar, India, 398–408
- Vučić V, Grabež M, Trchounian A, Arsić A. 2019. Composition and Potential Health Benefits of Pomegranate: A Review. *Current Pharmaceutical Design* **25**(16): 1817–1827. DOI: 10.2174/1381612825666190708183941
- Zamanian MY, Sadeghi Ivraghi M, Khachatryan LG, Vadiyan DE, Bali HY, Golmohammadi M. 2023. A Review of Experimental and Clinical Studies on the Therapeutic Effects of Pomegranate (*Punica granatum*) on Non-alcoholic Fatty Liver Disease: Focus on Oxidative Stress and Inflammation. *Food Science & Nutrition* **11**(12): 7485–7503. DOI: 10.1002/fsn3.3713
- Zhang H, Wang M, Yu G, Pu J, Tian K, Tang X, Du Y, Wu H, Hu J, Luo X, Lin L, Deng Q. 2023. Comparative Analysis of the Phenolic Contents and Antioxidant Activities of Different Parts of Two Pomegranate (*Punica granatum* L.) Cultivars: 'Tunisia' and 'Qingpi.' *Frontiers in Plant Science* **14**: 1265018. DOI: 10.3389/fpls.2023.1265018
- Zuhair Dardona. 2023. Literature Review: *Punica granatum* (Pomegranate) with an Emphasis on its Anti-Parasitic Activity. *GSC Biological and Pharmaceutical Sciences* **23**(2): 100–114. DOI: 10.30574/gscbps.2023.23.2.0192