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Review Article

Phytochemicals and Therapeutic Potential of Pomegranate: A Mini Review

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ABSTRACT

A significant source of polyphenolic chemicals is the pomegranate (Punica granatum). Due to the several pharmacological functions attributed to its phytochemicals, it has been gaining importance. An extensive list of the phytoconstituents present in pomegranate fruits, peel, blossoms, and seeds as well as their pharmacological actions were the goals of this in-depth analysis. The flavonoids and tannins (gallotannin and ellagitannin), which are the active phytochemicals in pomegranate extract, are what give it its anti-inflammatory, antioxidant, anti-angiogenic, and anti-aging qualities. Pomegranate bioactive components are used industrially to create foods with additional value. Wide-ranging applications for its reducing properties in the creation of nano formulations. Its phytoconstituents may play a safer role in managing environmental contamination than the use of pesticides or other chemicals. The numerous human clinical investigations assessing its pharmacological importance have received special attention.

INTRODUCTION

Small trees in the pomegranate genus include *Punica granatum* (family Lythraceae), also known as the pomegranate, which is indigenous to various Asian nations [1]. Pomegranates were used to embellish sarcophagi in ancient Egypt and were revered as symbols of ambition and wealth. Due to its many positive benefits on health promotion, this fruit was later referred to as "a pharmacy unto itself" in Ayurvedic medicine [2]. The pomegranate has long been regarded as a source of valuable therapeutic phytochemicals. Each of the following anatomical divisions of the tree and its fruits contains a wealth of bioactive compounds with medicinal properties. Peels and juice have been demonstrated to have high antioxidant capabilities, and peel, juice, and oil have modest estrogenic effects and can be used to treat postmenopausal symptoms [3]. Pomegranate peels that have been dried have been used to cure ulcers, aphtha, and diarrhea. It has been claimed that pomegranate seed, juice, and peel mixtures can stop abortions [4]. *Punica granatum*'s fruit is made up of many seeds that are enclosed in a white membrane and encircled

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by a thick skin called the pericarp, which makes up nearly half of the fruit's weight. The remaining 50% of the fruit is made up of a rill (40%) and a seed (10%). Only 10% of the weight of the fruit is made up of the seeds, which contain 20% oil on average [5]. The pomegranate juice has a much greater quantity of polyphenols [6]. A variety of bioactive compounds, including ellagitannins, polyphenols, flavonoids (luteolin, kaempferol, quercetin), and anthocyanidins (delphinidin, cyanidin, and pelargonidin), are abundant in the pericarp as shown in Figure 1. Additionally, it includes minerals [7] as well as complex polysaccharides. It is currently unclear whether pomegranate peel contains alkaloids like pelletierine, which were suggested to have integrative properties [8]. Pomegranate catechin with gallic acid were discovered by the chromatographic method. It has been demonstrated that delphinidin inhibits the proliferation of breast cancer cells. Additionally, this bioactive material was able to boost the potency of the targeted medications now in use in breast cancer cells that overexpressed the HER2 gene [9].

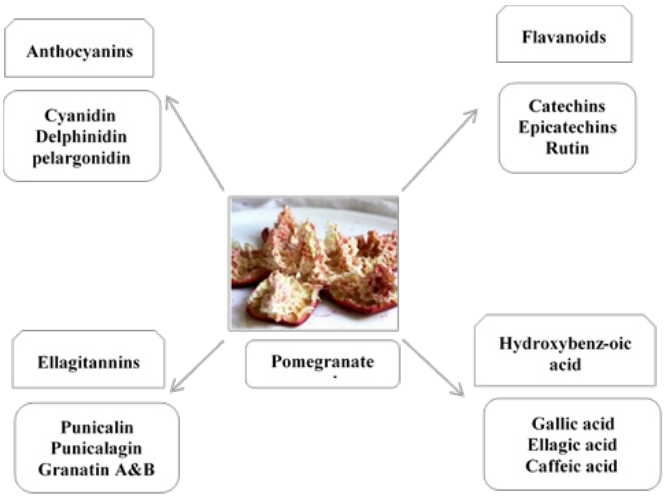

Figure 1: Chemical composition of pomegranate peel

Different functional components were found in different sections of the plant after phytochemical isolation and characterization. It has been demonstrated that tannins including gallagic acid, punicalin, pedunculagin, and ellagic acid are present in the pomegranate leaf extract. Triterpenoids and ursolic acids, including oleanolic acid and Asiatic acid, make up the flowers [10]. Conjugated fatty acids like linoleic and linolenic acid, as well as other lipids like punicic acid, palmitic acid, stearic acid, and phytosterols, are abundant in pomegranate seeds. The juice's polyphenols, tannins, anthocyanins, coenzyme Q10, and lipoic acid are widely considered to be a significant source of antioxidants [11]. There are several therapeutic effects of pomegranate. Some effects are described in Table 1.

Table 1: Therapeutic effects of pomegranate

Therapeutic effect	Description	References
Lung cancer	Pomegranate fruit extract has the ability to block a number of signaling pathways, making it useful for treating human lung cancer. Mitogen-activated protein kinases (MAPK), PI3K/Akt, and NF-B are examples of pathways. Additionally, mice implanted with A549 cells saw a 4-day delay in the development of tumors. These research show that pomegranate fruit extract has chemo preventive properties.	[12]
Skin cancer	Pomegranate oil has been demonstrated to reduce NF-B transcription, decrease proapoptotic caspase-3, and increase DNA repair, which are all factors in the prevention of cancer in mice and human SKU-1064 fibroblast cells.	[13]
Cardio-vascular diseases	Pomegranate juice has been shown to have impact on hypertension, inflammation, and atherogenesis in human and mouse models. It prevents angiotensin-converting enzyme and reduces systolic blood pressure. Punicic acid, the main constituent of pomegranate seed oil, has antiatherogenic effects. Pomegranate juice is a dual activator of PPAR in diabetic Zucker rats, it reduces hyperlipidemia, hyperglycemia, and fatty heart.	[14]
Osteoarthritis	Proinflammatory cytokines are the primary cause of osteoarthritis, a degenerative joint disorder, and by phosphorylating RUNX-2, MAPKs control inflammation and cartilage degradation. Pomegranate extract, which has a high polyphenol content, can stop IL-1 from activating MKK3, the DNA-binding capacity of RUNX-2 transcription factor, and the p38-MAPK isoform.	[15]
Antimicrobial/ fungal effect	Pomegranate has been shown to have antimicrobial properties, such as inhibition of Candida albicans, MRSA, and PVL toxin production, and improved antibacterial effects in isolated PVL, MSSA, and MRSA. It has also been shown to have strong antibacterial activity against Escherichia Coli.	[16]
Skin	Solar ultraviolet radiations induce protein oxidation, DNA damage, and the activation of matrix metalloproteinases, although pomegranate juice, extract, and oil can reduce UVB-induced protein expression and proinflammatory cytokines [17].	[17]
Dental effects	The preservation of the oral microbiota is correlated with the bacterial interactions with yeasts and the interbacterial coaggregations. 22 mm is the mean zone, dried, powdered pomegranate peel is said to exhibit substantial C. albicans suppression. The antiplaque effects of pomegranate mouthwash have been documented in another investigation. Additionally, pomegranate hydroalcoholic extract significantly reduced the number of bacteria in dental plaque by 84% (cfu/ml).	[18]
Reproductive system	Beta-sitosterol in pomegranate seed extract stimulates phasic activity in rat uterus, protects against adrianycin-induced oxidative stress, and increases epididymal sperm concentration, motility, spermatogenic cell density, diameter of seminiferous tubules and germinal cell layer thickness.	[19]

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Therapeutic effect	Description	References
Wound healing	The wound area was significantly reduced after using pomegranate extract and flower, and the number of fibroblasts, collagen bands, and few inflammatory cells rose. In hydroalcoholic pomegranate extract, properties of increased wound contraction and the time of collagen, protein, and epithelialization production were reported.	[20]

CONCLUSIONS

The pomegranate (*Punica granatum*) is a significant source of polyphenolic chemicals with anti-inflammatory, antioxidant, anti-angiogenic, and anti-aging qualities. Its phytoconstituents, flavonoids and tannins, have led to patent applications and industrial applications. Clinical trials are needed to demonstrate the safety and effectiveness of its phytoconstituents before they can be turned into medications.

Authors Contribution

Conceptualization: MKN, MUMA, TF, ZA
Writing-review and editing: AH, ZS, SI, TN, FH, MAI, MKN
Author have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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