

**Biological Potential of Pomegranate: A Mini review****Nabia Hafeez***Centre of Biotechnology and Microbiology, University of Peshawar, KPK, Pakistan.***Abstract:**

Medicinal plants have been utilized for the cure of diseases for hundreds of years. Among the variety of plants, *Punica granatum* is an important plant whose fruit possesses significant ecological, nutritional, ornamental, and medicinal value. The presence of polyphenols (flavonoids, tannins, and anthocyanins), complex polysaccharides, and minerals contribute to its significant antioxidant nature and biological impetus in the treatment of various diseases. The fruit, peel, and its seeds are characteristically important to treat cancer, cardiovascular disorders, osteoporosis, bacterial and fungal infections, and male infertility.

**Keywords:** *Punica granatum*, biochemistry, pharmacology\*Corresponding author's email: [nabiahafeez@hotmail.com](mailto:nabiahafeez@hotmail.com)

Pomegranate, also known as *Punica granatum*, is a predominant specie; belonging to the family Lythraceae. *Punica granatum* is a fruit tree; significantly known for its immense nutritional, ecological, ornamental, and medicinal potential [1]. It is a drought-resistant and long-lived plant; particularly dominant in semi-arid and arid regions of the world. They are extensively cultivated in both; Mediterranean and Asian countries. These regions include countries like Morocco, Tunisia, Turkey, Spain, Egypt, India, and Iran [2]. *Punica granatum* grows in the form of trees that can grow up to 30 feet in height. Its leaves are oblong and narrow in shape with a 2 cm width and 3-7 cm long. Leaves grow in the opposite manner. Flowers are 3 cm in diameter ranging from pink, and orange to bright red hues with four to five petals. The fruit is edible, rounded, and hexagonal in shape (5-12 cm in diameter). Fruit weighs 200 g with thick skin. It consists of 600 arils with encapsulated seeds [3].

*Punica granatum* fruit is a biological treasure as the fruit itself not only possesses a variety of health potential but its peel also imparts characteristic antibacterial potency against *Bacillus cereus* and *Staphylococcus aureus*. Despite its great ornamental value, fruit is rich in antioxidants and is used in both fresh and processed forms as wine and juice [4]. *Punica granatum* seeds are used as dietary supplements. It's strong antioxidant potential help to reduce cancer risks, obesity, and lipid levels in the blood [5, 6, 7]. Depending upon the cultivation practice, climate conditions, region of growth, maturity, and storage methods, the chemical composition of *Punica granatum* varies [8]. Half of the total fruit content of this fruit consists of peel that serves as a reservoir for bioactive compounds like flavonoids, proanthocyanidin, ellagitannins, phenols, complex polysaccharides and minerals. These minerals include sodium, calcium, nitrogen, potassium, magnesium and phosphorus. The remaining half of the fruit consists of 10% seeds and 40% arils. These arils are made up of 85% water and 10% total sugars (fructose and glucose), and 1.5% pectin and organic acids. Among organic acids, fruit is richly supplied with malic acid, citric acid and ascorbic acid [9]. Fruit's seed cover consists of anthocyanins like delphinidin-3, 5-diglucoside, delphinidin-3-glucoside,

cyanidin-3-glucoside, pelargonidin-3-glucoside, pelargonidin-3, 5-diglucoside and cyanidin-3,5-diglucoside [10]. The seeds consist of 70% conjugated linolenic acids (punicic acid). 12–20% of total seed weight comprises seed oil. Seeds' fatty acid component consists of 95% of the oil; mostly triacylglycerols. It also contains steroids and sterols; a key component of mammalian myelin sheaths called cerebrosides [11, 12]. Thus, these phenolic compounds including tannins, anthocyanins, and flavonoids are the chief antioxidants that characteristically contribute to its free radical scavenging and biological activities [13]. Oil extracted from *pomegranate* seed is richly supplied with fatty acids. It contains 14 fatty acids. Among these, puniceic acid is the most abundant fatty acid available with a percentage of 71.85–77.78%. Both seeds and sprouts of pomegranate are an important reserve for minerals such as magnesium (97.41–187.59 mg/100g) and calcium (99.49–238.25 mg/100g) [14].

*Punica granatum* fruit exhibits a range of therapeutic effects. They have been found effective against AIDS, Alzheimer's disease, cancer, diabetes, cardiovascular problems, aging, and male infertility [15, 16]. The fruit showed angiogenic inhibition in MCF-7 breast cancer cell lines and human umbilical vein endothelial cell lines by down-regulating vascular endothelial growth factor (VEGF) [17]. Also, the juice was found effective against the prostate cancer cell line. The molecular analysis illustrated the inhibition of cell-adhesion-related genes and cellular migration. This resulted in the apoptotic, antioxidant, anti-inflammatory and anti-proliferative potency of *Punica granatum* [18]. Also, the polyphenolic content in the juice resulted in the reduction of atherogenesis by lowering the oxidative stress via activation of redox-sensitive genes ELK-1 and p-JUN, thereby increasing eNOS expression. Studies revealed that the consumption of *Punica granatum* juice by patients with heart problems for 3 years showed a reduction in blood pressure and LDL oxidation. Anti-oxidant nature increased nitric oxide bioavailability and preservation helped in smooth muscle relaxation and increased intracavernous blood flow in treating arteriogenic erectile dysfunction in rabbit model treated with eight weeks administration of *Punica granatum* juice. Thus, this juice has the anti-atherogenic potential to treat cardiovascular disorders [19-22]. The hydroxyl group present in the polyphenols reduce the free radical content. Moreover, catecholic hydroxyl groups present in both condensed and complex tannins help in the chelation of transition metals and iron [23]. These tannins contribute towards the antibacterial potency of pomegranate by mechanisms such as metal ion depletion, enzymatic activity inhibition and membrane protein precipitation [24]. It is also found effective against dental plaque, oral inflammation, fungal and bacterial counts in Candida-associated denture stomatitis and periodontal disease [25, 26]. Also, the ellagitannins found in pomegranate help in producing a compound (urolithin A) in the gut. This compound not only reduces inflammation in the brain but it also delays the onset of cognitive diseases [27]. The juice has also shown promising results against HIV-1 IIIB using CD4 and CXCR4 as cell receptors. This proved it as anti-HIV microbicide [28]. *Pomegranate* peel powder possesses bio-sorbent properties which make them a suitable candidate to recover heavy metals from water [29]. Research showed that 3% pomegranate peel powder serves as a natural preservative as it can help in producing high-quality beef sausage samples during a storage period of 12 days at 4 °C [30].

Also, Hartman utilized *Punica granatum* fruit to study Alzheimer's disease by inducing symptoms of the aforementioned disease in transgenic mice. Results revealed that six months of continuous use of *Punica granatum* juice improved memory tests and learning abilities as compared to the control group used in the study. This also helped in a 50% reduction of plaques

in brain cells. Plaques are clumps of beta-amyloid proteins that clump together and disrupt normal communication between nerve cells; causing brain inflammation [31]. Researchers have also found the effectiveness of *Punica granatum* juice in improving sperm quality, morphology, and motility ensuring enhanced fertilization rates [32]. Pomegranate also supports urinary health by regulating the concentration of calcium, phosphates, and oxalates in the blood as they are responsible for the formation of kidney stones. Also, research on adults (18-70 years) with kidney stones treated with 100 mg of pomegranate extract for 90 days showed inhibitory potency of stone formation in the body [33, 34].

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