



Nutritional and Medicinal Evaluation of Pomegranate

Taufeeq Ahmad¹, Sanjiv Kumar Maheshwari¹, Saba Siddiqui^{2*} and Latafat¹

¹Institute of Biosciences and Technology, Shri Ramswaroop Memorial University, Lucknow, India

²Integral Institute of Agriculture Science & Research Technology (IIAST), Integral University, Lucknow, India

ABSTRACT

Pomegranate is known as *Punica granatum*, belongs to the Monogeneric family, Punicaceae, predominantly found in China, Iran, USA and the Himalayas in northern India, all through the Mediterranean district. For thousands of years, the practice of Ayurvedic medicine has alleviated illnesses and attributed over all positive health by herbal medicines and has indicated the importance of pomegranate. These plants contain various bioactive ingredients used to cure different diseases. The therapeutic properties of these plants could be established on the cancer prevention agent, antimicrobial, antipyretic or pain relieving impacts of different Phytochemicals. Recently, the reactions related with the activity of allopathic medications have brought about an expanded request for the phyto-pharmaceutical results of Ayurveda. In Unani drug, a Middle Eastern customary medicinal framework that later flourished in India. Pomegranate flowers fill in as a solution for Diabetes mellitus. In addition it has been used as a curative beautification and upgrade hormone substitution treatment, resolution of allergic symptoms, cardiovascular fortification, oral hygiene, ophthalmic ointment, weight reduction cleanser, and as an adjunct treatment to build bioavailability of radioactive dyes amid demonstrative imaging.

Keywords: *Punica granatum*; Antimicrobial; Antioxidant activity; Anticancer activity; Anti-diabetic

INTRODUCTION

Punica granatum, known as pomegranate, belongs to the Monogeneric family, Punicaceae, predominantly found in China, Iran, USA and the Himalayas in northern India [1,2]. Pomegranate is one of the endemic plants of India, developing in many districts all through the nation, in parched and semiarid areas because of its capacity to adjust to unfriendly environmental conditions. The world pomegranate production amounts to about 1,500,000 tons [3]. The religious epics of different religion also indicate the importance of pomegranate. As indicated by the sacred Quran, pomegranates develop in the patio nurseries of heaven and the Quran has recounted the pomegranate twice for instance of God's great manifestations (Surah Al Anaam, chapter 6, verse 99 and 141, Surah Ar-Rahman, chapter 55, verse 68). The Indian subcontinent has a rich greenery of different plants utilized as a part of conventional therapeutic medications [4]. For thousands of years, the practice of Ayurvedic medicine has

alleviated illnesses and attributed over all positive health by herbal medicines and has indicated the importance of pomegranate [5,6]. The therapeutic properties of these plants could be established as the cancer prevention agent, antimicrobial, antipyretic or pain relieving impacts of different Phytochemicals [7]. Recently, the reactions related with the activity of allopathic medications have brought about an expanded request for the phyto-pharmaceutical results of Ayurveda [8]. The different useful parts of pomegranate are summarized in the following figure which is has been used for the isolation of different nutraceuticals and medicinal compound (Figure 1).

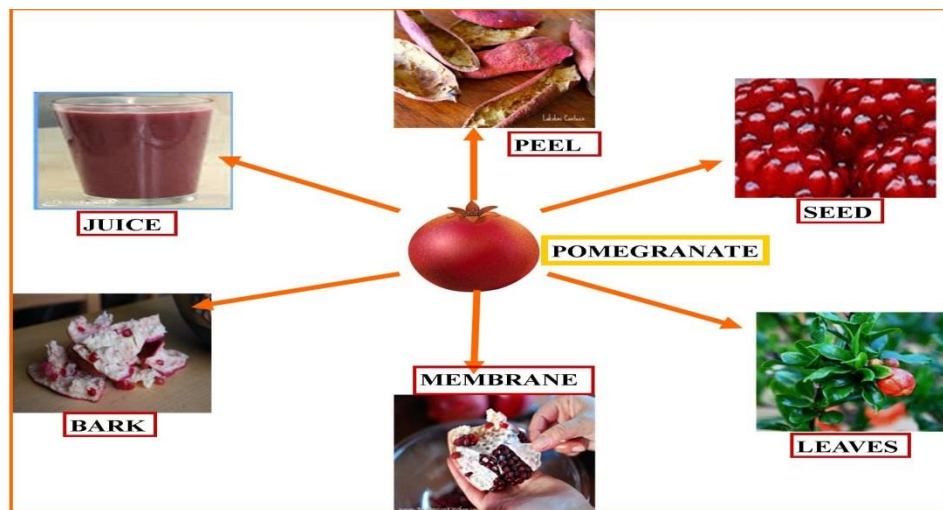


Figure 1. Different valuable parts of pomegranate

MORPHOLOGICAL ATTRIBUTES

Structure Shape Size

The edible fruit is a berry which is about 5-12 cm in width with a hexagonal shape, thick reddish skin and around 600 seeds, each encompassed by a water-loaded mash (aril) going in shading from white to dark red or purple. The pomegranate can be partitioned into a few anatomical compartments including seed, juice, peel, leaf, bark, and root with each having fascinating pharmacological and toxicological activities [9]. The pulp (aril) is the edible part of the fruit and its seeds are inserted in a white, light, astringent mash [10]. It is an ever green or deciduous and spiny plant with multiple trunks and small slender leaves with tiny stems that is believed to have originated in Iran then moved to the Himalayas in northern India. Heterostylous funnel-shaped red flowers are characteristic to this plant and are discovered also in singles or in clusters of up to five. The fruit is almost in circular with a crown on the base created by the calyx. The skin is tough and leathery in texture, yellow or deep pink/red in color, and about 2 to 5 inches in width. The inside of the fruit contains white elastic membranous walls that form compartments containing sacs

packed with a fleshy, juicy, red or whitish mash. Every sac holds an angular, soft or hard seeds which are typically red or white in shade. Around 52% of the mass, of the entire fruit is represented by these seeds [11]. Pomegranate is deficiency tolerant, winter hardy and can increase well under wasteland conditions, frequently affected by high saltiness, being proline considered as a possible drought stress indicator in pomegranate fruits [12].

Utilization of Pomegranate in Various Medicinal Fields

The pomegranate is identified with, life span, gentility, fruitfulness, information, ethical quality, everlasting status and deep sense of being, if not Divinity [13]. In the old Egyptian culture the pomegranate natural product was viewed as an image of flourishing and desire, making it regular practice to design sarcophagi with delineations of the plant. In Ayurvedic pharmaceutical the pomegranate is seen as "a medication store unto itself" the bark and roots acknowledged to have anthelmintic and vermifuge properties [14], the peels an extraordinary astringent and cure for looseness of the bowels of the insides and oral aphthae, and the juice a "refrigerant" [15] and "blood tonic" [16]. Producers from India [17], Tunisia [18], and Guatemala [19], itemized that the dried pomegranate peels are decocted in water and utilized both inside and externally for various issues requesting astringents as well as disinfectants, particularly for aphtha, diarrhoea and ulcers. The pomegranate seed squeeze and peel items incomprehensibly have been accounted for to not just counteract premature birth [20] but also conception [21-23]. In Unani drug, a Middle Eastern customary medicinal framework that later flourished in India [24] pomegranate flowers fill in as a solution for Diabetes mellitus [25]. Current employments of pomegranate inferred items now incorporate treatment of AIDS [26]. Not with standing use for remedial values [27,28] and redesign [29], hormone substitution treatment [30], determination of unfavorably susceptible indications [31], cardiovascular insurance [32,33], oral cleanliness [34], ophthalmic balm [35], weight diminishment chemical [36], and as an adjunct treatment to build bioavailability of radioactive dyes amid demonstrative imaging [37-39]. The different pomegranate nutrients are summarized in Table 1.

Table 1: Pomegranate's nutrient values for 100 g

| Composition | Content |
|--------------------|----------------|
| Water | 77.93g |
| Energy | 83 kcal |
| Protein | 1.67 g |
| Total lipid (fat) | 1.17 g |

| | |
|---------------|---------|
| Ash | 0.53 g |
| Carbohydrates | 18.70 g |
| Fiber | 4.0 g |
| Sugars | 13.67 g |
| Calcium | 10 mg |
| Iron | 0.3 mg |
| Magnesium | 12 mg |
| Phosphorus | 36 mg |
| Potassium | 236 mg |
| Sodium | 3 mg |
| Ascorbic acid | 10.2 mg |
| Choline | 7.6 mg |

The chemical composition of pomegranate depends upon the cultivar, growing region, maturity, cultivation practice, climate, and storage circumstances. Around half of the aggregate natural product weight relates to the peel, which is an essential wellspring of bioactive compounds, for example, phenolics, flavonoids, ellagitannins, and proanthocyanidin, minerals, K,N, Ca, P, Mg, & Na, and polysaccharides. The remaining half piece of the pomegranate organic product comprises of 40% arils and 10% seeds [40-42]. The useful chemicals of pomegranate are summarized in Table 2.

Table 2. Name of different compounds along with their parts

| S.No. | Pomegranate part | Chemical compound |
|-------|------------------|--|
| 1. | Peels | Gallic acid, Ellagic acid, Punicalin, Punicalagin, Caffeic acid, Ellagitannins, Pelletierine, alkaloids, Luteolin, Kaempferol, Quercetin |
| 2. | Seeds | 3,3'-Di-O-methylellagic acid, 3,3',4'-Tri-O-methylellagic acid, Punicic acid, Oleic acid, Palmitic acid, Stearic acid, Linoleic acid, Sterols, Tocopherols, Sex steroids |

| | | |
|----|---------------|---|
| 3. | Juice | Simple sugars, Aliphatic organic acids, Gallic acid, Ellagic acid, Quinic acid, Flavonols, Amino acids, Minerals, EGCG, Ascorbic acid |
| 4. | Leaves | Carbohydrates, Reducing sugars, Sterols, Saponins, Flavanoids, Tannins, Piperidine alkaloids, Flavone, Glycoside, Ellagitannins |
| 5. | Root and Bark | Ellagitannins, Piperidine alkaloids, Pyrrolidine alkaloid, Pelletierine alkaloids |
| 6. | Flower | Gallic acids, Ursolic acid, Triterpenoids, Fatty acids |

Different useful Parts of Pomegranate

Seed

Around 18% of dried and cleaned white seeds are containing oil. The oil is rich in punicic acid (65%), which is a triple conjugated 18- carbon unsaturated fat. There are some phytoestrogen in pomegranate seeds that engage in sexual relations steroid hormones like those in mankind. The 17-alpha estradiol is a perfect representation of estrogen [43].

Juice

Pomegranate juice is a very good source of glucose, sucrose, and fructose. It also has some of the simple organic acids such as ascorbic acid, citric acid, fumaric acid, and malic acid. In addition, it contains small amounts of all amino acids, specifically proline, methionine, and valine. Juices are rich in polyphenols and anthocyanins cause the red color of juice. Pomegranate juice has catechins with a high antioxidant activity. Ellagitannin is a sort of tannins; it can be separated into hydroxybenzoic acid, for example, ellagic acid. It is broadly utilized as a part of plastic surgeries, which avoids skin flap's death because of its cancer prevention activity. Two major constituents of ellagitannins presents in pomegranate juice are punicalagin and punicalin [44].

Peels (Pericarp)

Pomegranate Peel is rich in polyphenols. The biggest classes incorporate tannins and flavonoids that show pharmacological capability of pomegranate due to their bizarre antioxidative and additive exercises. A couple of classes of pomegranate flavonoids join anthocyanins, flavan 3-ols, and flavonols. Pomegranate peels have catechins with a high malignancy counteractive action specialist. They are basic mixes of anthocyanin's generation with

cancer prevention agent and fiery part. All pomegranate flavonoids demonstrate growth aversion activity with circuitous hindrance of incendiary markers, for instance, tumor rot factor-alpha (TNF- α).

Use of Pomegranate Peel (Pericarp)

Pomegranate peel is a rich asset of tannins, flavonoids and certain other phenolic chemicals [45]. Pomegranate peels are under evaluated as a rural waste; however it is a piece of an antiquated organic product with especially rich ethno-therapeutic applications and astringent properties [46]. Pomegranate peels goes about as eco-obliging waste because of its different uses, for instance, diminishing reason in making silver nanoparticle. Pomegranate peels likewise utilized for cows feed and extraction of normal colors [47]. Antibacterial and cancer prevention agent properties of pomegranate peel in-vitro frameworks have also been accounted [48-51]. However, pomegranate peel has set up less consideration as regular additives in meat. But two recent studies [52,53] no endeavors have been made to build up a characteristic additive from pomegranate peel. This review tried to assess the antimicrobial action of pomegranate peel against different basic maladies.

The pomegranate peel is accounted for to have a few medical advantages because of the presence of different tannins, flavonoids, alkaloids and organic acids. The peel of pomegranate has higher antioxidant activity than the pulp [54] and pomegranate peel contains higher cancer prevention agent than flower, leaf and seed. Pomegranate peels are described by an inside system of layers containing around 26– 30% of aggregate organic product in weight and are characterised by substantial amounts of phenolic compound, including flavonoids (anthocyanins, catechins and different flavonoids) and hydrolyzable tannins (punicalin, pedunculagin, punicalagin, gallic and ellagic acid). These compounds are stored in pomegranate peel and squeeze, which have 92% antioxidant activity related with the organic product [55-57]. The pomegranate peel is considered as an agro-squander anyway it can be a potential wellspring of growth anticipation specialists, phenols, and flavanoids and besides has antibacterial and antifungal activity. Pomegranate peel has capacity to rummage free radicals due to its high polyphenols and anthocyanins (consolidated tannins) [58]. There is a scope of phytochemical compounds in pomegranate that have indicated antimicrobial activity; however the vast majority of the analysts have discovered that ellagic acid and bigger hydrolysable tannins, for example, punicalagin, have the most essential activity. Not infrequently, the mixture of the pomegranate constituents compromises the most favourable benefit [59]. Additionally it has been utilized as traditional prescription for the treatment of dysentery, diarrhea and respiratory disease [60,61].

Numerous analysts have concentrated on the natural waste piece of this wonder fruit, pomegranate, to

discover numerous phenomenal impacts for human wellbeing. Phytotherapy is considered as an integral approach for averting and treating basic disease [62]. Therapeutic applications of pomegranate, that in Ayurvedic drug, the pomegranate is utilized as anti-parasitic operator, a blood tonic, and to heal aphate, diarrhoea and ulcers. In the Unani framework, in the Middle East and India, pomegranate was described also a solution for diabetes [63]. Numerous examinations show that pomegranate and its compound have distinctive pharmacological and toxicological properties including cancer prevention agent, calming (by repressing star provocative cytokines), against tumor and hostile to angiogenesis exercises. Gallagyldilacton, gallic acid, granatin B indicated anti-inflammatory activity [64-68]. Different examinations additionally reveal the biggest classes incorporate tannins and flavonoids show pharmacological capability of pomegranate because of its peculiar antioxidative and additive activities. The product of the pomegranate has widely been utilized as a customary cure against acidosis, looseness of the bowels, microbial contaminations, the runs, helminth disease, drain and respiratory pathologies [69]. Pomegranate seeds have additionally been appeared to contain the estrogenic mixes, estrone and estradiol. Moreover, specialists have discovered that the dried pericarp and the juice of the natural products are additionally helpful for treatment of colic, colitis, menorrhagia, cerebral pain, diuretic, skin irritation, heaps, unfavorably susceptible dermatitis and treatment of oral infection [70]. The peels (pericarp, skin or body) add up to roughly 60 % of the heaviness of the pomegranate fruit [71]. The Pomegranate peels have remedial properties. It is utilized as a part of treatment and avoidance for tumor [72,73], cardiovascular ailment, diabetes [74], dental conditions [75] and erectile brokenness [76], security from bright (UV) radiation and antimicrobial [77]. Other potential applications have baby mind ischemia, Alzheimer's illness, male infertility, joint inflammation, dermal injuries, and obesity. Keeping in mind the end goal to encourage look into on pomegranate, a summarized study on phyto-compound that contribute for anti-hyperglycemic, anti-lipidemic, and hepato-defensive impacts of pomegranate peel. Pomegranate peels as a treatment for prostate disease, especially intermittent kind of cells; in atherosclerosis by inhibiting the lipid per oxidation in plasma and in lipoproteins as well as the collagen induced platelet aggregation in human platelets. Pomegranate juice was additionally detailed compelling in hypertension by diminishing Angiotensin Converting Enzyme (ACE) activity; lessening myocardial ischemia and enhancing myocardial perfusion; in diabetes through an indispensable effect on atherogenesis through diminished oxidative stress; in periodontal disease and denture stomatitis.

**PHYSICOCHEMICAL COMPOSITION/NUTRITIONAL VALUES OF POMEGRANATE PEELS
(PERICARP)**

Studies demonstrated that Pomegranate peels is profoundly nutritive and contains critical crude materials like unrefined filaments, protein, and sugars. The syntheses of an ingredient are classified [78]. The chemical piece of pomegranate bagasse (the dried piece of the fiber that remaining parts once the juice is extricated) powder contains protein, fat, slag, add up to dietary fiber, insoluble dietary fiber, and solvent dietary fiber of 10.94, 20.86, 2.55, 50.29, 30.41, and 19.88g/100g, individually. Not with standing, the measurement of a few compositions, for example, vitamins, minerals, and other pharmacological properties must be assessed in Table 3.

Table 3. Nutrient content of pomegranate peel (per 100 g)

| Composition | Content |
|--------------------|----------------|
| Total solid | 94.50 |
| Moisture | 5.40 |
| Total sugars | 17.70 |
| Reducing sugars | 4.34 |
| Protein | 4.90 |
| Crude fiber | 16.30 |
| Fat content | 1.26 |
| Ash | 3.40 |

Chemical Composition of Pomegranate peels (Pericarp) –

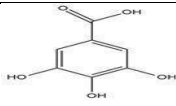
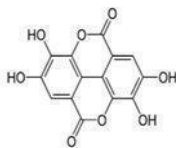
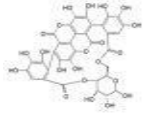
The different known compounds are summarized in Table 4 and Principal constituents of different parts of pomegranate with structures are summarized in Table 5.

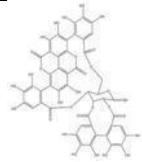
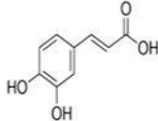
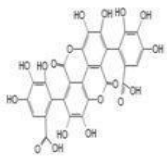
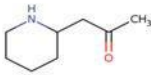
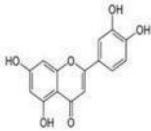
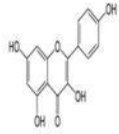
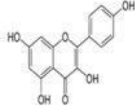

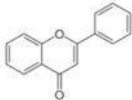
Table 4. The different known compounds

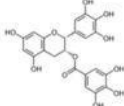
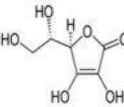
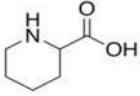

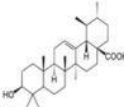
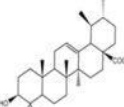
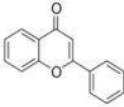
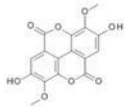
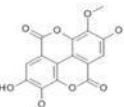
| S.No. | Amino acid | Mineral | Vitamins | Fats |
|--------------|-------------------|----------------|-----------------------------|-----------------|
| 1. | Lysine | Calcium(Ca) | Thiamine (B1) | Myristic C 14:0 |
| 2. | Methionine | Magnesium(Mg) | Riboflavin (B2) | Palmitic C 16:0 |
| 3. | Cysteine | Potassium (K) | <i>L</i> -Ascorbic acid (C) | Srearic C18:0 |
| 4. | Isoleucine | Sodium (Na) | α -Tochoferol (E) | Arachidic C20:0 |
| 5. | Leucine | Phosphorus (P) | Retinol (A) | Behenic C22:0 |






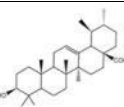
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|-----|---------------|---------------|--|--|
| 6. | Phenylalanine | Iron (Fe) | | Oleic ω-9 C18:1 |
| 7. | Tyrosine | Zinc (Zn) | | Stearoleic C18:1 |
| 8. | Histidine | Manganse (Mn) | | Gadoleic C20:1 |
| 9. | Aspartic | Copper (Cu) | | Erucic C22:1 |
| 10. | Glutamic | Selenium (Se) | | Linoleic ω-6 C18:2 |
| 11. | Serine | | | Punicic (9, 11, 13) all cis C18:3 |
| 12. | Glycine | | | Arachedonic w6 (3, 8, 11, 14) all cis C 20:4 |
| 13. | Arginie | | | Ecosapentaenoic C20:5 |
| 14. | Alanine | | | Docosatetraenoic C22:4 |
| 15. | Proline | | | Other fatty acid |

Table 5. Principal constituents of different parts of pomegranate with structures

| S.No. | Compound Name | Chemical formula | Molecular Weight | Structure | Plant Part (Pomegranate) | Reference |
|-------|---------------|--|------------------|--|--------------------------|-----------|
| 1. | Gallic acid | C ₇ H ₆ O ₅ or C ₆ H ₂ (OH) ₃ COOH | 170.12 g/mol |  | Peel, Juice, flower | [79] |
| 2. | Ellagic acid | C ₁₄ H ₆ O ₈ | 302.194 g/mol |  | Peel, Juice | [80] |
| 3. | Punicalin | C ₃₄ H ₂₂ O ₂₂ | 782.528 g/mol |  | Peel | [81] |

| | | | | | | |
|-----|---------------------------|----------------------|-------------------|---|-----------------------------|------|
| 4. | Punicalagin | $C_{48}H_{28}O_{30}$ | 1084.722 g/mol |  | Peel | [82] |
| 5. | Caffeic acid | $C_9H_8O_4$ | 180.159 g/mol |  | Peel | [83] |
| 6. | Ellagitannins | $C_{44}H_{32}O_{27}$ | 992.713 g/mol |  | Peel, root, bark, leaves | [84] |
| 7. | Pelletierine alkaloids | $C_9H_{15}NO$ | 153.225 g/mol |  | Peel, root, bark | [85] |
| 8. | Luteolin | $C_{15}H_{10}O_6$ | 286.239 g/mol |  | Peel | [86] |
| 9. | Kaempferol | $C_{15}H_{10}O_6$ | 286.239 g/mol |  | Peel | [65] |
| 10. | Quercetin | $C_{15}H_{10}O_7$ | 302.238 g/mol |  | Peel | [67] |
| 11. | Quinic acid | $C_7H_{12}O_6$ | 192.167 g/mol |  | Juice | [87] |
| 12. | Flavonols | $C_{15}H_{10}O_3$ | 238.242 g/mol |  | Juice | [88] |

| | | | | | | |
|-----|---|-------------------------------------|------------------|---|--------------------|------|
| 13. | EGCG | $C_{22}H_{18}O_{11}$ | 458.375 g/mol |  | Juice | [89] |
| 14. | Ascorbic acid | $C_6H_8O_6$ or $HC_6H_7O_6$ | 176.124 g/mol |  | Juice | [79] |
| 15. | Piperidine Alkaloids | $C_5H_{11}N$ or $CH_2(CH_2)_4NH$ | 85.15 g/mol |  | Root, bark, flower | [85] |
| 16. | Pyrrolidine Alkaloid | C_4H_9N | 71.123 g/mol |  | Root, bark | [84] |
| 17. | Ursolic acid | $C_{30}H_{48}O_3$ | 456.711 g/mol |  | Flower | [90] |
| 18. | Triterpenoids | $C_{29}H_{44}O_5$ | 472.666 g/mol |  | Flower | [91] |
| 19. | Flavone | $C_{15}H_{10}O_2$ | 222.243 g/mol |  | Leaves | [8] |
| 20. | 3,3'-Di-O- methylellagic acid | $C_{16}H_{10}O_8$ | 330.248 g/mol |  | Seed | [92] |
| 21. | 3,3',4'-Tri-O- methylellagic acid | $C_{17}H_{12}O_8$ | 344.275 g/mol |  | Seed | [93] |

| | | | | | | |
|-----|---------------|--|------------------|---|------|------|
| 22. | Punicic acid | $C_{18}H_{30}O_2$ | 278.436 g/mol |  | Seed | [94] |
| 23. | Oleic acid | $C_{18}H_{34}O_2$ or $C_8H_{17}CH=CH$ $(CH_2)_7COOH$ | 282.468 g/mol |  | Seed | [95] |
| 24. | Palmitic acid | $C_{16}H_{32}O_2$ | 256.43 g/mol |  | Seed | [96] |
| 25. | Stearic acid | $CH_3(CH_2)_{16}C$ OOH or $C_{18}H_{36}O_2$ | 284.484 g/mol |  | Seed | [86] |
| 26. | Linoleic acid | $C_{18}H_{32}O_2$ | 280.452 g/mol |  | Seed | [94] |
| 27. | Tocopherols | $C_{28}H_{48}O_2$ | 416.69 g/mol |  | Seed | [93] |

THERAPEUTICAL PROPERTIES OF POMEGRANATE (*PUNICA GRANATUM*) PEEL EXTRACT

Antimicrobial

The capacity of avoiding infections of extracts of pomegranate is at present well documented. Nevertheless, studies concerning this issue have continued. Therefore, works searching natural antimicrobials against these pathogens is a great goal of the scientists. Different concentrates of pomegranate peels, primarily 80% methanolic concentrate of peel uncovered to be an intense inhibitor of *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli* and *Yersinia Enterocoliti* causing both in-vitro and in-situ strategies. The course of action of pomegranate juice and polyphenols was additionally viable alongside nourishment borne viral infectivity. Without culturable human

noroviruses, cat calicivirus (FCV/F9), murine norovirus (MNV/1), and MS2 (ssRNA) bacteriophage were used as foodborne viral surrogates. That amalgamation was capable of causing diminishment of sustenance borne viral surrogates FCV-F9, MNV-1 and MS2 (particularly on low titers). In totaling, pomegranate decontaminated polyphenol separate restrained flu infection having additionally a synergistic impact with oseltamivir. Flu infection causes pestilences and pandemics in human populace. The investigation achieved that punicalagin show in the pomegranate remove had virucidal ability and repressed flu infection RNA multiplication autonomous on the virucidal impact. Not with standing this the synergistic impact of sanitized polyphenol extricate with oseltamivir.

These analysts announced that punicalagin detached from pomegranate peels had solid action against *Candida albicans* and *Candida parapsilosis* as well as the mix of punicalagin and fluconazole demonstrated a synergistic communication. TEM analysis revealed that, treated cells with punicalagin showed thickened cell membrane, space between cell membrane and, vacuoles, and reduction in cytoplasmic components. Denture stomatitis is commonly associated with *C. albicansal* anyway other *Candida* species have been disconnected from wounds [97]. The use of pomegranate things prompts a fundamental amassing of ellagitannins in the substantial processing tracts, where they interface with complex gut microflora [98]. As demonstrated by the examinations performed by these specialists the business concentrate of pomegranate gave by POM Wonderful (Los Angeles, CA) and punicalagins controlled the advancement of pathogenic clostridia and *Staphylococcus aureus*. Regardless the probiotic lactobacilli and bifido minuscule living beings were not influenced by ellagitannins. The development restraint for pathogenic microorganisms and according to comparative makers could be credited to the lower media pH as a result of the nearness of punicalagins. In any case, this investigation was just performed in vitro and the creators likewise elude the significance of phenols digestion that happens in gut. As record in the last passage, punicalagins and ellagic acid are processed to urolithins by colonic microorganisms and the activity might be changed, along these lines they recommend the requirement for playing out extra examinations utilizing human fecal microbiota Therapeutic use of pomegranate peel are shown in Figure 2.

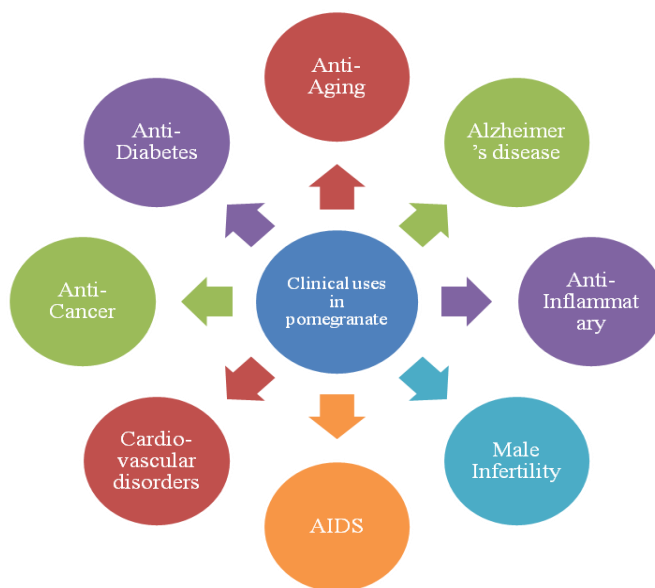


Figure 2. Therapeutic use of pomegranate peel

Antioxidant Activity

Reactive oxygen species (ROS) are a group of molecules produced by some metabolic processes, because of the activity of oxidases in the mitochondria or other cell compartments. Reactive oxygen species (ROS) have high reactivity since they have unpaired electrons that can communicate with oxidizable substrates through redox responses. The main Reactive oxygen species (ROS) involved in the biological systems are superoxide anion, hydroxyl radical, hydroperoxyl and peroxy radical, nitric oxide, and other reactive species [99-100]. Though, other reactive molecules derived from Reactive oxygen species (ROS) with nitric oxide or thiols (reactive sulfur species) [101]. The natural cancer prevention agent protection is made out of endogenous antioxidants, which are enzymatic, and non-enzymatic cancer prevention agents created by our own particular body, and exogenous antioxidant, which can be fused through the eating routine or nourishing supplements [102]. Moreover, there is another group that contains synthetic cancer prevention agents broadly utilized as a part of the food industry, for example, butylatedhydroxyanisole (BHA), butylatedhydroxytoluene (BHT), propyl gallate (PG), and tert-butylhydroquinone (TBHQ). Generally, pomegranate had the best antioxidant activity, independent on the cancer prevention agent test examined with direct relationship between phenolics concentration and antioxidant capacity [103-104].

Anticancer Activity

Advance research on breast malignancy cell lines perceived that pomegranate fixing effectively restrained

angiogenesis process [105], obtrusiveness, development [106], and initiated apoptosis [107]. It's against obtrusive, anti-proliferative, and anti-metastatic properties were perceived to the adjustment of Bcl-2 proteins, up-control of p27 and p21, and down direction of cyclin-cdk arrange [108]. Pomegranate ingredients inhibit angiogenesis down-regulating vascular endothelial growth factor (VEGF) in human and breast cancer cell lines (MCF-7), thus reduce tumor development. Prostate growth cells, while treated by pomegranate juice, expanded grip and diminished the movement. As a result of its apoptotic, cancer prevention agent, anti-proliferative, and anti-inflammatory properties, that it might be valuable in slowing down or anticipating malignancy cell metastasis [109]. Pomegranate extract were used to elucidate the anticancer properties by repressing erythemas and hyperplasia and epithelial ornithine decarboxylase on mice skin [110]. The Transgenic Adenocarcinoma of the Mouse Prostate (TRAMP) mice, an in vivo study demonstrated that oral supplementation of pomegranate natural product distinct hindered metastasis and ensure survival [111]. Constituents of pomegranate limit tumor cell attack into regular tissue and metastasis too far off destinations and these activities create because of the restraint of chose metalloproteinase action, diminished central bond kinase action, and decreased VEGF articulation. Pomegranate fruit extract was presented to inhibit UV B-mediated phosphorylation of mitogen-actuated protein kinase (MAPK) and nuclear factor NF- κ B enactment [112]. Pomegranate squeeze nearly down regulated the TNF α incited Akt (protein kinase B) initiation required for NF- κ B action [113-114] inspected the impacts of pomegranate extract on the IGF framework and discovered cell growth inhibition and apoptosis.

Anti-diabetic

Over the previous decade, critical advance has been made in establishing the anti-hyperglycemic pharmacological component of Pomegranate peels and the discrete combinations accountable for it. Numerous solvent abstracts of peels give the impression of anti-diabetic property. On their Jordanian medicinal plants review, native authors have uncovered 61% traditional healers prescribe Pomegranate peels for diabetes treatment [115]. Similar kind of studies done by the authors in India also revealed the uses of Pomegranate Peels by established healers (vaidya) (approx 49%) and anti-hyperglycemic effect using in vitro glucose oxidase method. The preliminary research on the anti-diabetic properties of peels was confirmed by in vivo study [116-124]. Diabetic rats treated with 0.43 g/kg B.W. of aqueous peel extract for a month showed altogether brought down glucose level and expanded number of β cells which generally help in strengthening of insulin level. The mechanistic anti-diabetic activity of the extract is by stimulation, recovery, and expanded number of β cells, by securing pancreatic tissue and resulting release of insulin.

Also, it may increase the stimulation and activation of insulin receptor.

Cardiovascular illness

Atherosclerosis is one of the leading causes of death, particularly in developed countries where a higher percentage of atherosclerotic deaths are observed. Low density lipoproteins (LDL) accumulate in the interior layers of blood vessels and then undergo oxidation, a process that generates harmful species. Hindrance of Low thickness lipoproteins (LDL) oxidation is thought to be a decent technique to prevent the accumulation of foam cells and, at last, cholesterol stores in the arteries. Because of its excellent antioxidant activity, Pomegranate Peel extract can possibly inhibit Low thickness lipoproteins (LDL) oxidation and subsequently hinder the movement of atherosclerosis with a huge diminishment of arterial foam cell levels. The pomegranate polyphenols punicalagin, gallic acid, and to lesser degree ellagic acid, increment hepatocyte paraoxonase- 1 expression and secretion in a dosage reliant, consequently subsiding atherosclerosis risk [125-126]. The cardiovascular illness preventive impacts of Pomegranate Peel ellagitannins (10-100 mM) have been seen in vitro however; moderately lesser cardio-protective impacts of pomegranate ellagitannins were seen in vivo. The cardio-protective impacts of Pomegranate extract (100 mg/kg) in a rodent have been all the more as of late illustrated by means of a diminishment in creatine kinase-MB, lactate dehydrogenase and glutathione. There have been numerous reports on the constructive outcomes of Pomegranate polyphenols and their possession of oxidation sensitive qualities, nitrous oxide synthase articulation restraint potential, [127] and down control of redox sensitive ELK-1 and p-JUN genes and endothelial nitrous oxide articulation under incited endothelial divider shear stress [128-129]. On the side from the of biochemical efficiency associated with extracts, peel powder has also been considered as a nutritional properties to cure hypercholesterolemia and atherosclerosis. Dietary supplementation with peel powder at a grouping of 5, 10 and 15g/100g for a time of a four weeks fundamentally reduced serum adds up to cholesterol, triglycerides, Low density lipoproteins (LDL) and lipid per oxidation levels in hyper cholesterolemic rats [130].

Anti-inflammatory and Anti-allergic Properties

The weight of fascinating precise indication about the beneficial reimbursements of pomegranate and its segments has built a scientific consensus that pomegranate rind methanolic extract have the capability to inhibit inflammation and allergies [131]. The anti- inflammatory compound of Pomegranate Peel, i.e., punicalagin, punicalin, strictinin A and granatin B essentially reduces creation of nitric oxide and PGE2 by restraining the outflow of expert pro-inflammatory proteins [132-133]. Obviously, inflammatory cells including neutrophils, macrophages and monocytes

may inflict damage to near-by tissues, an occasion thought to be of pathogenic significance, for example, chronic obstructive pulmonary disease, acute respiratory disease, atherosclerosis, malignancy and rheumatoid arthritis [134].

Anti-influenza and Anti-malarial Responses

Pomegranate hydrolysable contains tannin with other biological compound showed antiviral response that balances respiratory contaminations and influenza [135]. The antiviral properties have been attributed to inhibition of RNA replication of the flu infection by pomegranate-purified polyphenol extract. Punicalagin compounds with inhibitory concentrations of up to 40 mg/ml have been appeared to be the most dynamic in blocking viral RNA replication [136]. Similarly, peel phenolics inactivate infections by means of direct structural damage and aberrant intercellular inhibition of viral replication. Glycoprotein-wrapped infections have been accounted for to be more defenses less to basic harm by polyphenols contrasted with non-enveloped infections [137]. Another current examination illustrated the antiviral capability of pomegranate polyphenols. The examination revealed that a brief timeframe outline (5 min) introduction of avian and human flu infections (H1N1, H3N2, and H5N1) to 800 mg/ml pomegranate polyphenols carried about a 3-log decrease of viral titer at room temperature [138].

CONCLUSION

The persistence of this examination is to elucidate the pharmaceutical importance and different ordinary combinations in the pomegranate especially the peel of pomegranate. Around half of the aggregate natural product weight relates to the peel, which is an essential wellspring of bioactive compounds, for example, phenolics, flavonoids, ellagitannins, and proanthocyanidin, minerals, They are contain potassium, nitrogen, calcium, phosphorus, magnesium, and sodium, and complex polysaccharides. The reaming half piece of the pomegranate organic product comprises of 40% arils and 10% seeds. Arils parts contain approximately 85% water, sugars (fructose and glucose), and gelatin, organic acid, malic acid, and bioactive compound. Then several parts have been tested medically for the treatment of different disease like Alzheimer, anti-aging, anti-diabetes, anti-cancer, cardiovascular disorder, AIDS, and other immune-disease.

CONFLICT OF INTEREST

The authors conform that this article content has no conflict of interest.

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