

The Nutritional Value of Pomegranate, a Functional Fruit and an Ancient Medicine [†]

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Abstract: Pomegranate is native to Mediterranean regions and Iran which have been extensively used in different cultures and countries. Nutrient components of pomegranate peel is moisture, total solid, protein, total sugars, reducing sugars, fat contents, ash, and crude fiber. Fatty acids identified in pomegranate seed are punicic acid, caproic acid, myristic acid, lauric acid, palmitic acid, myristoleic acid, stearic acid, palmitoleic acid, oleic acid, and linoleic acid. Chemical components in pomegranate seeds are 3,3,4-Tri-O-methylellagic acid, 3,3-Di-O-methylellagic acid, folic acid, punicic acid, stearic acid, palmitic acid, sterols, linoleic acid, sex steroids and tocopherols. Chemical components in pomegranate peels are ellagic acid, gallic acid, punicalagin, punicalin, ellagitannins, caffeic acid, alkaloids, pelletierine, quercetin, luteolin, and kaempferol. Chemical ingredient in pomegranate juice are aliphatic organic acids, simple sugars, ellagic acid, gallic acid, flavonols, quinic acid, EGCG, amino acids, minerals, and ascorbic acid. The contents of pomegranate leaves are reducing sugars, carbohydrates, saponins, sterols, tannins, flavonoids, alkaloids, piperidine, glycoside, flavone, and ellagitannins. The major chemical components in bark and root are piperidine alkaloids, ellagitannins, pelletierine alkaloids, and pyrrolidine. Flower chemical components are ursolic acid, gallic acids, fatty acids, and triterpenoids. The most notable pharmacological benefits of pomegranate are in cancer prevention, reduce inflammation in the gut and improve digestion, antioxidant activity, Alzheimer's disease protection, important anti-inflammatory fruit, antiviral activity, high potential to lower systolic blood pressure, a good source for potential fertility aid, rich in different vitamins like vitamin K, C, E, and an important source of potassium and folate. The aim of this manuscript is to introduce and survey the most important pharmacological benefits of pomegranate.

Keywords: pomegranate; glycoside; medicinal plants; kaempferol; natural products; ascorbic acid; ellagic acid

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1. Introduction

Traditional medicinal plants have different ranges of chemical components, and they have become popular due to effectiveness, frequently inadequate provision of modern medicine, cultural beliefs, and preferences [1–10], and the principle modification functions of medicinal herbs and plants in traditional herbal and medicinal sciences have been received considerable attentions in countries like China, Iran, India, Japan and other parts of the world in recent years [16–21]. Pomegranate (*Punica granatum* L.) which is a perennial fruit tree from the Punicaceae native in Iran has been considered as a function fruit in many parts of the world such as China, Iran, Turkey and India [21–39]. As a functional food and nutraceutical source, pomegranate fruit quality depends on growing conditions and climate [38,39]. The pomegranate has narrow and lance-shaped leaves which are

glossy and leathery, and the attractive scarlet, white or variegated flowers are over an inch across and have 5 to 8 crumpled petals and a red, fleshy, tubular calyx which persists on the fruit. The pomegranate is self-pollinated as well as cross-pollinated by insects, and cross-pollination increases the fruit set and wind pollination is insignificant. The wide fruit is crowned at the the base by the prominent calyx, the leathery, tough skin or rind is typically yellow overlaid with deep pink, light or rich red. Its classifications are on the basis of agronomical characteristics, especially shape and color [35–41]. This ancient medicine has been mentioned in the Bible and the Kora as a symbol fertility [42,43]. The goal of the article is survey on the most notable pharmaceutical advantages and health benefits of pomegranate with considering traditional knowledge and modern science of natural products. The current searching was done by the keywords in main indexing systems including Scopus, PubMed/MEDLINE, Institute for Scientific Web of Science, and search engine of Google Scholar. The keywords were health benefits, traditional medicine, pomegranate, pharmaceutical science, punicalagin, punicalin, and ellagitannins.

2. Pomegranate and Pharmacological Benefits

The most notable components of pomegranate are amino acids such as methionine, lysine, isoleucine, cysteine, leucine, tyrosine, phenylalanine, aspartic, histidine, serine, glutamic, arginine, glycine, proline, and alanine, and the most important minerals are magnesium, calcium, sodium, potassium, iron, phosphorus, manganese, zinc, selenium, and copper; vitamins are riboflavin, thiamine, α -Tocopherol, L-Ascorbic acid, and retinol; Fats such as palmitic, myristic, arachidic, stearic, stearoleic, behenic, ecosapentaenoic, erucic, gadoleic, docosatetraenoic, others [44–46]. Approximate composition of pomegranate seeds is percentage moisture (8.6%), total lipids (27.2%), crude fiber (35.3%), crude protein (13.2%), total sugars (4.2%), pectin (6%), and ash (2%); trace minerals present in pomegranate seeds sodium (6 ppm), iron (1.3 ppm), potassium (45.2 ppm), magnesium (12.4 ppm), copper (1.2 ppm), and zinc (1 ppm) [47]. Its peels contain ellagic acid, gallic acid, punicalin, caffeic acid, punicalagin, ellagitannins, alkaloids, pelletierine, kaempferol, luteoline, and quercetin. Its seeds contain oleic acid, punicic acid, stearic acid, palmitic acids, sterols, linoleic acid, and tocopherols. Its juice contains gallic acid, ellagic acid, simple sugars, aliphatic organic acids, quinic acid, amino acids, minerals, flavonols, EGCG and ascorbic acid. Its leaves contain reducing sugars, carbohydrates, saponins, sterols, tannins, flavanoids, flavone, piperidine alkaloids, ellagitannins and glycoside. The root and bark contains piperidine alkaloids, ellagitannins, pelletierine alkaloids, and pyrrolidine alkaloid. The chemical components of its flower are ursolic acid, gallic acids, fatty acids and triterpenoids. Iran traditional medicine, it may helpful for treating diseases such as dysentery, diarrhea and stomach disorders [48], and tannin content of pomegranate seed is commonly used to treat wound healing and women discharge [49].

The potentiated virucidal activity of pomegranate and extract by co-administered zinc has potential as a multi-action novel topical therapeutics against *Herpes simplex virus* (HSV) infections like cold sores [50]. Pomegranate peel extract was capable to boost the functional characteristics of chitosan/gelatin-based materials enhancing the desired properties for their potential application as food coatings [51]. Pomegranate juice shows microbial properties for both oral hygiene and chemo-preventive in immune deficiency and cardiovascular diseases [52], with tremendous anti-atherogenic and anti-atherosclerotic characteristics for decreasing high blood pressure and density lipoprotein oxidation [53]. Pomegranate juice has the potential as a nutraceutical to improve health span and lifespan in human beings [54], and the pomegranate vinegar may prevent a high-fat diet (HFD)-induced obesity and obesity-related cardiac complications because of anti-adiposity and anti-inflammatory properties of vinegar [55]. The fruits of some pomegranate genotypes could be used to obtain extracts very rich in punicalagins and these substances could be used as an alternative to synthetic products to control plant disease and improve the quality of the plant products, avoiding the effect of synthetic chemicals on environment [56]. The main pharmaceutical advantages of pomegranate are acute pancreatitis,

Alzheimer, anti-depressant effects, anti-diabetes effects, anti-diarrheal activity, anti-cancer activity, anti-inflammatory and analgesic impacts, antioxidant activity, anti-microbial activity, anti-bacterial properties, anti-aging, anti-apoptotic, anti-hepatotoxic effects, anti-ulcer, appropriate for skin care, and useful for vertigo and wound healing [57–65]. The most important biological impacts of methanol extract of pomegranate fruits are antiestrogenic in breast, no induction of proliferation in endometrial, ovarian, and cervical cancer cells, suppressed TNF- α mediated endothelial cell apoptosis, estrogen inducible gene expression was not changed, reduced LDL cholesterol levels cardioprotective effect, no DNA adduct formation or oxidative DNA damage [66–68].

3. Conclusions

Pomegranate belongs to the family of Punicaceae, and its numerous pharmacological benefits are because of presence of wide range of different bioactive components. The major lignans and alkaloids in peel are isolariciresinol and punigratane, respectively. Pomegranate fruit has been proven to treat various diseases such as cancer, diabetes, AIDS, male infertility, Alzheimer's disease, cardiovascular disorders, coronary heart disease, aging and inflammation. Pomegranate is a high potential natural functional food and a super fruit because of having different pharmacological benefits as an important and ancient effective natural drug.

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