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A review article on Pomegranate (Punica granatum).

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Abstract :

Pomegranate (Punica granatum) is most important plant belonging to family Lythraceae. A symbol of fecundity and divine femininity emerges, whose fruit rinds, bark and roots are used worldwide as taenicides, owing to alkaloids, and treatment of diarrhea and oral and genital lesions, owing to tannins and astringency. The seeds contain oil which contains not only the steroidal estrogen, estrone, in the highest concentration found in any botanical species, but also a full range of non-steroidal phytoestrogens including the comesten, coumestrol, and the isoflavones, genistein and daidzein. Both the juice and the oil contain numerous and diverse bioflavonoid, which have been shown to be both potently antioxidant and inhibitory of one or both of the enzymes cyclooxygenase (catalyzing arachidonic acid to prostaglandins) and lipoxygenase (catalyzing arachidonic acid to leukotrienes). Extracts of the rinds have been shown to be bactericidal, antiviral, antitumor and use of pomegranates in the treatment of Acquired Immune Deficiency Syndrome (AIDS) owing to their antioxidant properties and botanical uniqueness. This present study is designed to evvaluate the phytochemical and pharmacological profile of different extract of Punica granatum.

Keyword: Pomegranate, cultivation, pharmacological profile, and phytoestrogens

Introduction

: The pomegranate is a native plant to Caucasus and Northern Africa. Mountains can be found all over the Southern United States. The Latin words "pomum" (apple) and "granatus" (full of seeds) are the source of the English word "pomegranate." Old French is the source of the botanical name, which translates to "pomegranate apple." It belongs to the Lythraceae family. The Punicaceae family includes the pomegranate. Since antiquity, it has been grown and allowed to naturally occur throughout the entire Mediterranean region. It is native to the region extending from Iran to the Himalayas in northern India (Meerts and others 2009). Actually, pomegranates are widely grown throughout Iran, India, Mediterranean nations, Malaysia, the East Indies, tropical Africa, the drier regions of Southeast Asia, California and Arizona in the United States, China, Japan, and Russia (Fadavi and others 2006). The world pomegranate production is nearly 15 × 105 tons [7] and peels amounts to about 60% of the total pomegranate fruit weight [8]. When not processed properly, this by-product becomes a very serious problem causing environmental pollution. Generally, vegetables and fruits wastes have been used as fertilizers and animal feeds Attempts have been made to utilise. The edible parts of pomegranate fruits are consumed fresh or used for the preparation of fresh juice, canned beverages, jelly, jam, and paste and also for flavoring and coloring beverage products (Fadavi and others 2005; Mousavinejad and others 2009). In addition, it is widely used in therapeutic formulas, cosmetics, andfood seasonings. Since ancient times, the pomegranate

has been regarded as a “healing food” with numerous beneficial effects in several diseases (Vidal and others 2003). Indeed, the pomegranate was commonly used in folk medicine, for eliminating parasites, as an antihelmintic and vermifuge, and to treat and cure aphtae, ulcers, diarrhea, acidosis, dysentery, hemorrhage, microbial infections, and respiratory pathologies. It was also used as an antipyretic (Larrosa and others 2010; Lee and others 2010). At the present time, considerable importance is given to functional foods, which, in principle, apart from their basic nutritional functions, provide physiological benefits and play an important role in disease prevention or slow the progress of chronic diseases (Viuda-Martos and others 2010b). There has been a virtual explosion of interest in the pomegranate as a medicinal and nutritional product because of its

multifunctionality and its great benefit in the human diet as it contains several groups of substances that are useful in disease risk reduction. As a result, the field of pomegranate research has experienced tremendous growth (Mart´ınez and others 2006; Jaiswal and others 2010). The aim of this review was to present an overview of the functional, medical, and physiological properties of the pomegranate.

Chemical Composition of Pomegranates:

The pomegranate fruit (Figure 1) has valuable compounds in different parts of the fruit. These can be divided into several anatomical origins: peel, seeds, and arils. Another importantproduct obtained from pomegranate fruit is the juice that can be obtained from arils or from whole fruit. According to Poyrazoglu and colleagues (2002; Barzegar and colleagues 2004; Fadavi and colleagues 2005), the chemical content of the fruits (Table 1) varies based on the cultivar, growing region, climate, maturity, cultivation practise, and storage circumstances. Over the years, numerous researchers have noted significant variations in the organic acids, phenolic compounds, sugars, water-soluble vitamins, and minerals of pomegranates (Aviram and others 2000; Mirdehghan and Rahemi 2007; C am and others 2009; Davidson and others 2009; Tezcan and others 2009). The peel makes up about half of the weight of the fruit and is a significant source of minerals, particularly potassium, nitrogen, calcium, phosphorus, magnesium, and sodium (Li and others 2006), as well as complex bioactive compounds like phenolics, flavonoids, ellagitannins (ETs), and proanthocyanidin compounds.

Bioavailability of Pomegranate Bioactive Compounds:

Although the data in favour of pomegranate consumption is very encouraging, further research is necessary to completely understand its potential impact on human health before it can be advised. usage on a regular basis (Syed and others 2007). We don't know a lot about how substances are absorbed, bioavailable, distributed, and processed the major bioactive substances found in pomegranates are even though they undoubtedly follow similar processes, phenolic acids, flavonoids, and tannins in different fruits (Petti and Scully)Aglycones, specifically the nonconjugated forms, are often Esters, glycosides, and other compounds are absorbed intact from the digestive tract,or must be hydrolyzed prior to absorption of polymers (Petti and 2009 (Scully). Pomegranate juice's in vitro digestion was investigated. indicated that a significant quantity (29%) of pomegranate phenolic chemicals are accessible during digestion.

Phytochemical Analysis:

Phytochemical analysis of various extracts revealed that tannins were present in ethylacetate and methanolic extracts, but absent in dichloromethane and hexane extracts.It has been reported that various herbs containing tannins as main constituent have astringent effect and are used for the treatment of diarrhea and dysentery [32]. Therefore, pomegranate peels can be used in herbal cure remedies. Anticancer activity of tannins has also been reported [33]. Tannins have been found to be 15-30 times more effective than simple phenolics in quenching peroxyl radicals [34]. Another phytochemical observed was saponins which were detected only in hexane extract. Saponins have been known for anti-inflammatory and anti- cancer properties [35]. Saponins also help to reduce cholesterol and blood glucose level in human body [36]. They are therefore probably important in human diets to reduce the risk of coronary heart diseases [37]. Due to the presence of saponins, pomegranate peels can be used to manage inflammation and heart problems. Terepenoids and alkaloids were absent in all extracts. Glycosides and steroids were present in all extracts. Steroids are of importance in pharmacy due to their relationship sex hormones [38]. They also reduce inflammation and promote immune functions in the skin [39]. Carbohydrates were detected in ethyl-acetate and methanolic extracts but absent in dichloromethane and hexane extracts. Phenols were present in all extracts. Flavonoids were also present in all extracts except hexane. Phenols and flavonoids provide protection against oxidative stress induced diseases and are mainly responsible for antioxidant activity of peels [40]. Phenolic compounds have received much attention due to their ability to prevent the oxidation of low density lipoproteins causing artherosclerosis, protect body against cancer and heart diseases due to their antioxidant activity [41, 42]. The phytochemical screening results (Table2) obtained are almost similar as reported by Sadik and Asker [43].

Fertilization:

Generally the trees are given 2 to 4-ounce applications of ammonium sulfate or other nitrogen fertilizer the first two springs. After that very little fertilizer is needed, although the plants respond to an annual mulch of rotted manure or other compost.

1. Antioxidant effects

everal phytochemicals with antioxidant properties have been isolated from edible and non-edible parts of the pomegranate. Among the identified compounds, anthocyanins, ellagic acid and ellagitannins, gallic acid and gallotannins, ferulic acid, catechins, and quercetin are the most represented (29,30). The antioxidant activity of these phytocompounds is mediated via different mechanisms, such as the inhibition of lipid peroxidation, scavenging or neutralizing reactive oxygen species (ROS), activating or inhibiting several signaling pathways and modulating gene expression.

Notably, in 2020, Morittu *et al* (38) performed an *in vitro* and *in vivo* study to explore whether the purification of pomegranate juice could ameliorate the already known antioxidant properties of this fruit by using a polyvinylidene fluoride fiber. In the *in vitro* β-carotene bleaching test, natural and clarified juices were tested at

concentrations of 0.5-100 µg/ml. Specifically, despite a lower amount of phenols, the filtered juice exhibited a higher antioxidant activity (IC_{50}, 19.7 µg/ml following 30 min of incubation) compared to the natural juice (IC_{50}, 51.5 µg/ml following 30 min of incubation)

In the *in vivo* study (mouse model), 500 mg/kg of body weight of purified or natural juice dissolved into 0.2 ml of water were daily administered for 28 days. Specifically, the purified product reduced oxidative stress more than the unfiltered juice, as demonstrated by the reduction of reactive oxygen metabolites (d-ROMs). In addition, the processed juice induced a significant decrease in the levels of different markers for hepatic and heart damage, such as alanine aminotransferase (ALT), aspartate aminotransferase (AST) and creatine-phosphokinase (CPK). The obtained data further underline the benefits of pomegranate in maintaining homeostasis and health status. Moreover, these results suggest that the filtration system could be useful to enhance the beneficial effects of pomegranate

2. Anti-inflammatory effects

Inflammation represents the first defensive barrier of the human immune system against foreign agents and tissue damage. It occurs through two steps, acute and chronic. However, when inflammation persists and becomes chronic, it can be harmful to the body . Indeed, it has been shown that chronic inflammation is involved in the onset of several inflammatory disorders and chronic diseases, such as inflammatory bowel disease, rheumatoid arthritis and chronic obstructive pulmonary disease . At the same time, dysfunctional inflammatory responses have been implicated in the development of other non-communicable diseases, including obesity, diabetes, insulin resistance, atherosclerosis and illnesses affecting the nervous system.

Similarly, the anti-inflammatory properties of phenolic compounds that characterize pomegranate pericarp (punicalagin, gallic and ellagic acid) and their mechanisms of action were previously investigated . Briefly, the researchers used increasing concentrations of pomegranate pericarp extract (1.0, 2.5, 5.0, 10 and 25 µg/ml) to perform an *in vivo* and *ex vivo* study. The treatment with pericarp extract led to a significant reduction in the secretion of C-X-C motif chemokine ligand 8 (CXCL8) in both the human colorectal adenocarcinoma model (Caco-2 cells) and mammalian intestinal model (porcine colonic tissues) at all tested concentrations . This result further confirms the anti-inflammatory activity of pomegranate; indeed, CXCL8, also known as IL-8, is a cytokine predominantly implicated as a chemoattractant towards neutrophils under inflammatory conditions. In addition, to elucidate the mechanisms of action of phytochemicals deriving from pomegranate pericarp, the authors of the study evaluated the expression of different cytokines involved in inflammatory process . Of note, the expression levels of IL-1A and IL-6 were significantly decreased in the treated colonic tissues compared to the control in a concentration-dependent manner. Overall, the study highlights that pomegranate pericarp extract has high anti-inflammatory properties, particularly at the concentration of 5 µg/ml, suggesting that it may play a key role in modulating inflammatory bowel disease.

3. Anti-aging properties

Aging is a biological process that plays a key role in the development of several pathological conditions, such as neurodegenerative diseases or osteoporosis . The main cause of neurodegenerative diseases is represented by a progressive loss of brain cells associated with the deposition of proteins with altered physicochemical properties, known as misfolded proteins . The proteins involved in the pathogenesis of the main neurodegenerative diseases are β-amyloid in Alzheimer's disease, α-synuclein in Parkinson's disease, huntingtin (HTT) in Huntington's disease, prion protein (PrP) in Creutzfeldt-Jacob's disease and superoxide dismutase-1 (SOD1) in amyotrophic lateral sclerosis .

In another study, a rat model of Parkinson's disease was used to evaluate the effects of pomegranate juice. The authors of that study demonstrated that the daily intake of pomegranate juice (500 mg/kg of body weight) significantly reduced both the impairment of the postural reflexes and the loss of neural cells, two characteristic aspects of this disease. At the same time, pomegranate juice exhibited antioxidant and anti-inflammatory

properties, as demonstrated by the reduction in the levels of ROS, as well as the increase in mitochondrial aldehyde dehydrogenase 2 (ALDH2) and antioxidant enzyme activity. In addition, to further confirm the neuroprotective effects of pomegranate juice, the research group detected the level of α-synuclein, whose deposition on neurons represents one of the main causes of Parkinson's disease. Of note, the administration of pomegranate juice reduced α-synuclein accumulation in the treated rats compared to the untreated ones. Overall, the obtained results highlight the potential of pomegranate juice to attenuate Parkinson's disease in rats, indicating that daily supplementation of pomegranate juice may play a key role against this pathology. However, further studies are required in order to completely understand the mechanisms of action of phytocompounds contained in juice.

4. Leaves:

The pomegranate has glossy, leathery leaves that are narrow and lance-shaped

5. Flowers:

The nearly round, 2-1/2 to 5 in. wide fruit is crowned at the base by the prominent calyx. 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 flowers may be solitary or grouped in twos and threes at the ends of the branches. The pomegranate is self-pollinated as well as cross-pollinated by insects. Crosspollination increases the fruit set. Wind pollination is insignificant

6. Fruit:

Fruit The nearly round, 2-1/2 to 5 in. wide fruit is crowned at the base by the prominent calyx. The tough, leathery skin or rind is typically yellow overlaid with light or deep pink or rich red. The interior is separated by membranous walls and white, spongy, bitter tissue into compartments packed with sacs filled with sweetly acid, juicy, red, pink or whitish pulp or aril. In each sac there is one angular, soft or hard seed. High temperatures are essential during the fruiting period to get the best flavor. The 15 Pomegranate may begin to bear in 1 year after planting out, but 2-1/2 to 3 years is more common. Under suitable conditions the fruit should mature some 5 to 7 months after bloom.

7. THERAPEUTIC USE:

The pomegranate has been used in natural and holistic medicine to treat sore throats, coughs, urinary infections, digestive disorders, skin disorders, arthritis and to expel tapeworms. However, modern research suggests that pomegranates might to be useful in treating such serious conditions as prostate cancer, skin

cancer, osteoarthritis and diabetes. Studies also show that pomegranate seeds might help rid the digestive system of fats. Clinical research shows that pomegranates, when part of a healthy diet, might help prevent heart disease, heart attacks and strokes. This is because pomegranates have the potential to thin the blood, increase blood flow to the heart, reduce blood pressure, reduce plaque in the arteries, and reduce bad cholesterol while increasing good cholesterol.

Conclusion :

It is therefore concluded that pomegranate fruit peels are good source of nutrients such as carbohydrates, crude fibres and various photochemical. So they can be used as substrates deficit in either of these nutrients and as an alternative medicine in the treatment of human disorders. Methanolic extract of pomegranate fruit peel also has potential to reduce oxidative stress in human beings due to its antioxidant property which is almost comparable to that of standard ascorbic acid. Thus, methanol can be used as a solvent for extracting various antioxidants from pomegranate fruit peels. As consumption of pomegranate fruit is increasing day by day which is accompanied by increase in the volume of fruil peels generated. So fruit peels being good source of various bioactive compounds can be used as dietary supplements and nutraceuticals. This will help in complete utilization of the fruit waste providing extra income to the industries and will also solve the problem of environmental pollution due to poor dumping of fruit peels.

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