

Pomegranate: An Exotic Fruit with Rich Antioxidants

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Abstract

Pomegranates are being hyped up as a miracle drug since ancient times. It is an exotic fruit having many therapeutic benefits. They are rich source of Antioxidants, Vitamin C, Potassium, Iron, Fiber, and many of phytochemicals compounds which have protective health effects against cardiovascular, oncological, and neurological disorders. Several evidence also suggest that pomegranate have more therapeutic benefits.

Keywords: Pomegranates; Therapeutic Benefits; Antioxidants; Phytochemicals.

Introduction

The pomegranate, botanical name *Punica granatum* [1] are considered as the 'fruits of paradise' in ancient cultures. They've been found in Egyptian tombs, eaten by Babylonian soldiers prior to battle and incorporated into Persian wedding ceremonies to symbolize a joyous future. From ancient times Pomegranate has been grown widely in parts of the United States, Afghanistan, Russia, India, China, and Japan. It is a rich nutritious fruit with unique taste and flavor and also have many health promoting characteristics. Every part of the pomegranate plant including the fruit juice, peel, arils, flowers, and bark have medicinal values. Research also indicates that pomegranates and their extracts may serve as natural alternatives due to their potency against a wide range of bacterial and viral pathogens. Various phytochemical compounds in pomegranate have demonstrated antimicrobial activity, but most of the studies have found that ellagic acid and larger hydrolyzable tannins, such as punicalagin, have the highest activities.

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Received on 20.04.2017, Accepted on 09.05.2017

In Unani system of medicine practiced in the Middle East and India pomegranate serves as a remedy for diabetes [2]. Even in Ayurvedic medicine the pomegranate is considered "a pharmacy unto itself". It is used as a "blood tonic, [3] and antiparasitic agent [4] and to heal diarrhea, and ulcers [5]. Several lines of modern scientific evidence also indicates the therapeutic efficacy of pomegranate against different types of disorders [6].

Nutritive Value of Pomegranate



Pomegranate Nutrition Value per 100g
(Source from USDA)

Minerals	Nutrient Value
Calcium	10mg
Copper	18%
Iron	0.30mg
Magnesium	12mg
Manganese	0.119mg
Phosphorus	36mg
Selenium	0.5µg
Zinc	0.35mg

Nutrient Value	
Energy	83 kcal
Carbohydrates	18.70 g
Protein	1.67g
Total Fat	1.17g
Cholesterol	0 mg
Dietary Fiber	4g

Vitamins	Nutrient Value
Folates	38 µ
Niacin	0.293 mg
Pantothenic acid	0.135 mg
Pyridoxine	0.075 mg
Riboflavin	0.053 mg
Thiamin	0.067 mg
Vitamin A	0 IU
Vitamin C	10.2 mg
Vitamin E	0.60 mg
Vitamin K	16.4 µg

Pomegranate is moderate in calories, contains about 83 calories per 100 grams. It has no saturated fats. It is a good source of soluble and insoluble dietary fibers; providing about 4 grams per 100 g. The fruit is also good source of antioxidant vitamin-C, provides about 10.2 mg per 100 g. Further, it is also good source of many vital B-complex groups of vitamins such as folates, pyridoxine, pantothenic acid (vitamin B-5), and vitamin K, and minerals like potassium, calcium, copper, and manganese.

Therapeutic Benefits of Pomegranate

The most therapeutically beneficial pomegranate constituents are polyphenols - ellagitannins, ellagic acid (including punicalagins), punicalic acid, flavonoids, anthocyanidins, anthocyanins, and estrogenic flavonols and flavones.

Ellagitannin can be broken down into hydroxybenzoic acid such as ellagic acid. Two other ellagitannins that are found in both pomegranate juice and peel are punicalagin and punicalin. Pomegranate juice and peel have catechins with a high antioxidant activity. Level of antioxidants have been found to be higher than in other natural juices and even in red wine. They are so powerful that pomegranate juice has been found to have three times the antioxidant activity of red wine and green tea [7]. It is also widely used in plastic surgeries, which prevents skin flap's death due to its antioxidant activity.

Punicic acid, is a major bioactive nutraceutical compound found in pomegranate seed. A study done in 2014 [8] concluded that Punicic acid is a potential

nutraceutical and should be encouraged for use both as a prophylactic and therapeutic agent. Several classes of pomegranate flavonoids include anthocyanins, flavan 3-ols, and flavonols. These are essential compounds of anthocyanin's production with antioxidant and inflammatory role. All pomegranate flavonoids show antioxidant activity with indirect inhibition of inflammatory markers such as tumor necrosis factor-alpha (TNF- α) [9]. Anthocyanins are responsible for the red color of juice.

Pomegranates are Cardio Protective

Antioxidants have numerous positive properties, including protection against cholesterol oxidation, anti-aging effects and protection against atherosclerosis.

Esmailzadeh A et al [10] assessed the effect of concentrated pomegranate juice consumption on lipid profiles of type II diabetic patients with hyperlipidemia and they found that after consumption of concentrated pomegranate juice significant reductions were seen in total cholesterol ($p < 0.006$), low-density lipoprotein-cholesterol (LDL-c) ($p < 0.006$), LDL-c/high-density lipoprotein-cholesterol (HDL-c) ($p < 0.001$), and total cholesterol/HDL-c ($p < 0.001$). Their study concluded that pomegranate juice consumption could modify heart disease risk factors in these hyperlipidemic patients.

Another study by Aviram & Dornfeld [11] demonstrated a 5% decline in systolic blood pressure with daily consumption of 50 ml of pomegranate juice for two weeks. Both males and females were studied, with each participant on anti-hypertensive pharmacological therapy. Lowered blood pressure resulted from a direct interaction of the pomegranate juice with serum angiotensin converting enzyme. In a randomized, double-blinded, placebo-controlled study at the Preventive Medicine Research Institute in Sausalito, pomegranate juice drinkers with coronary artery disease had a 17% improvement in blood flow compared with an 18% worsening in the control group. The study team concluded that the antioxidants in the juice may help prevent the formation of fatty deposits on artery walls. Several studies also support that Pomegranate phytochemicals reduce LDL oxidation [12] have blood pressure-reducing properties [13] and many cardioprotective functions.

Anti-Cancer Properties of Pomegranates

Pomegranate's antioxidant activity is known to

inhibit cell proliferation and invasion, and promote apoptosis in various cancer cells [14]. A study also proved that pomegranate extract was found to inhibit the growth of human breast cancer cells by inducing cell death [15]. Pomegranate fruit has been shown to have the inhibitory efficacy against prostate cancer and lung cancer. It can be exploited in chemoprevention and chemotherapy of prostate cancer. A 2013 study examined the anti-cancer efficacy of pomegranate fruit grown in Taiwan against urinary bladder urothelial carcinoma and its mechanism of action. The analytical results of this study help to provide insight into the molecular mechanism of induced bladder cancer cell apoptosis by pomegranate and to develop novel mechanism-based chemopreventive strategy for bladder cancer [16].

A research also demonstrated that pomegranate oil has chemopreventive efficacy in mice. Reduced tumor incidence (7%), decrease in tumor numbers, reduction in ornithine decarboxylase activity (17%), significant inhibition in elevated Tissue plasminogen activator-mediated skin edema and hyperplasia, protein expression of ornithine decarboxylase, and epidermal ornithine decarboxylase activity have been reported with pomegranate oil treatments [17,18].

Adams et al. [19] examined the effects of pomegranate juice on inflammatory cell signaling proteins in HT-29 human colon cancer cell line. At a concentration of 50 mg/l, pomegranate juice significantly suppressed TNF α -induced (COX)-2 protein expression by 79% and also reduced phosphorylation of the NF- κ B/p65 subunit and its binding to the NF- κ B response element. These data suggest that polyphenolic constituents in the pomegranate can play an important role in the modulation of inflammatory signals in colon cancer cells. Pomegranate also has anti-angiogenic properties, they help to prevent growing tumors from acquiring a blood supply, preventing those tumors from receiving the nutrients that would allow them to grow larger [20,21].

Pomegranate and Osteoarthritis

The most common forms of arthritis are osteoarthritis and is a major progressive degenerative joint disease, which could affect joint functions and quality of life in patients. According to research published in the *Israeli Medical Association Journal* [22] concluded that Pomegranate may help reduce joint pain and decrease inflammation in arthritis sufferers. Arthritis is mediated by proinflammatory cytokines such as IL-1 and TNF- α . MAPKs are

important due to their inflammatory and cartilage damage regulation [23] P38-MAPKs are responsible for regulating cytokine production, neutrophils activation, apoptosis, and nitric oxide synthesis. The MAPK family phosphorylates a number of transcription factors such as runt-related transcription factor-2 (RUNX-2) [24]. Pomegranate extract, with its rich source of polyphenols, can inhibit IL-1 α -induced activation of MKK3, DNA-binding activity of RUNX-2 transcription factor, and p38 α -MAPK isoform [23].

Mélanie Spilmont 2015 [25] study also investigated whether the consumption of pomegranate peel extract could limit the process of osteopenia. They demonstrated that in ovariectomized mice, pomegranate peel extract consumption was able to significantly prevent the decrease in bone mineral density (-31.9%; $p < 0.001$ vs. OVX mice) and bone microarchitecture impairment. Their findings concluded that pomegranate peel extract may be effective in preventing the bone loss associated with ovariectomy in mice, and offers a promising alternative for the nutritional management of this disease.

Guards Memory and Brain Function

Pomegranate supplements taken before and after surgery prevented the postoperative memory dysfunction associated with coronary artery bypass or heart valve surgery [26]. In a latest study [27] subjects with self-reported memory problems were randomly assigned to receive 8 ounces of pomegranate juice of a placebo with similar flavor. Over a four-week study period, the subjects participated in memory tests, MRI scans, and blood draws. Those participants in the pomegranate juice group saw "*significant improvement*" in their verbal memory tests and their plasma antioxidant levels. They even showed increased brain activity during memory and verbal testing, suggesting the juice helped encourage increased blood flow to "critical task-related" regions of the brain. The onset of Alzheimer's disease also can be slowed and some of its symptoms curbed by a natural compound that is found in pomegranate. Also, the painful inflammation that accompanies illnesses such as rheumatoid arthritis and Parkinson's disease could be reduced, according to the findings of a two-year project headed by University of Huddersfield scientist Dr Olumayokun Olajide, who specialises in the anti-inflammatory properties of natural products. Braidy *et al.* [28] also demonstrated that the pomegranate juice extract can ameliorate 1-methyl-4-phenyl-1, 6-tetrahydropyridine (MPTP)-induced neurotoxicity in human primary neurons by

attenuating redox imbalance to a greater extent and slowing down age-related neurodegeneration. Although there are no proven methods to delay the onset or slow down the progression of AD, PD, and ALS, recent studies suggest that dietary interventions can alleviate the risk of neurodegeneration.

Conclusion

Pomegranates have been cherished for their exquisite beauty, flavor, color, and health benefits for centuries. Pomegranate has anti-inflammatory effects that may protect against cancer and other chronic diseases [29]. Many studies have also shown that they have incredible benefits for your body, and may lower the risk of all sorts of diseases [30]. Pomegranate is an ideal fruit for human health.

References

- Newman R. Sydney, Australia: Readhowyouwant; A wealth of phtochemicals. Pomegranate: The Most Medicinal Fruit (Large Print 16pt) 2011.p.184.
- Saxena A, Vikram NK. Role of selected Indian plants in management of type 2 diabetes: a review. *J Itern Complement Med* 2004;10:369-378.
- Lad V, Frawley D. *The Yoga of Herbs*. Santa Fe, NM:Lotus Press; 1986:135-136.
- Naqvi SA, Khan MS, Vohora SB. Antibacterial, antifungal, and antihelminthic investigations on Indian medicinal plants. *Fitoterapia* 1991;62:221-228.
- Caceres A, Giron LM, Alvarado SR, Torres MF. Screening of antimicrobial activity of plants popularly used in Guatemala for treatment of dermatomucosal diseases. *J Ethnopharmacol* 1987;20:223-237.
- Sedigheh Asgary, Mahtab Keshvari, Amirhossein Sahebkar, Mohamad Hashemi, and Mahmoud Rafieian-Kopaei, Clinical investigation of the acute effects of pomegranate juice on blood pressure and endothelial function in hypertensive individuals, *ARYA Atheroscler*. 2013 Nov;9(6):326-331.
- Gil MI, Tomás-Barberán FA, Hess-Pierce B, Holcroft DM, Kader AA. Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. *J Agric Food Chem*. 2000 Oct;48(10): 4581-9.
- Anusree SS, Priyanka A, Nisha VM, Das AA, Raghu KG, An in vitro study reveals the nutraceutical potential of puniceic acid relevant to diabetes via enhanced GLUT4 expression and adiponectin secretion. *Food Funct*. 2014 Oct;5(10):2590-601.
- Newman RA, Lansky EP, Block ML. Pomegranate: The Most Medicinal Fruit. Laguna Beach, California: Basic Health Publications; A Wealth of Phytochemicals; 2007.p.120.
- Esmailzadeh A, Tahbaz F, Gaieni I, Alavi-Majd H, Azadbakht L. Concentrated pomegranate juice improves lipid profiles in diabetic patients with hyperlipidemia. *J Med Food* 2004;7:305-8.
- Aviram M., and Dornfeld L.: Pomegranate juice consumption inhibits serum angiotensin converting enzyme activity and reduces systolic blood pressure. *Athero* 2001;158:195-198.
- Aviram M, Rosenblat M, Gaitini D, et al: Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation. *Clin Nutr* 2004;23:423-433.
- Aviram M, Volkova N, Coleman R, et al: Pomegranate phenolics from the peels, arils, and flowers are antiatherogenic: studies in vivo in atherosclerotic apolipoprotein e-deficient (E0) mice and in vitro in cultured macrophages and lipoproteins. *Journal of Agricultural and Food Chemisry* 2008;56:1148-1157.
- Proteomics. 2012 Nov;12(21):3251-62.
- J Med Food*. 2005 Winter;8(4):469-75
- Suppression of urinary bladder urothelial carcinoma cell by the ethanol extract of pomegranate fruit through cell cycle arrest and apoptosis. Lee ST, Lu MH, Chien LH, Wu TF, Huang LC, Liao GI - *BMC Complement Altern Med* - January 1, 2013;13:364.
- Hora JJ, Maydew ER, Lansky EP, Dwivedi C. Chemopreventive effects of pomegranate seed oil on skin tumor development in CD1 mice. *J Med Food*. 2003;6:157-61.
- Syed DN, Malik A, Hadi N, Sarfaraz S, Afaq F, Mukhtar H. Photochemopreventive effect of pomegranate fruit extract on UVA-mediated activation of cellular pathways in normal human epidermal keratinocytes. *Photochem Photobiol*. 2006;82:398-405.
- Adams LS, Seeram NP, Aggarwal BB, Takada Y, Sand D, et al. Pomegranate juice, total pomegranate ellagitannins, and punicalagin suppress inflammatory cell signaling in colon cancer cells. *J Agric Food Chem*. 2006;54:980-985.
- Khan N, Afaq F, Kweon MH, et al: Oral consumption of pomegranate fruit extract inhibits growth and progression of primary lung tumors in mice. *Cancer Res* 2007;67:3475-3482.
- Sartippour MR, Seeram NP, Rao JY, et al: Ellagitannin-rich pomegranate extract inhibits angiogenesis in prostate cancer in vitro and in vivo. *Int J Oncol* 2008;32:475-48.
- Balbir-Gurman A, Fuhrman B, Braun-Moscovici Y, Markovits D, Aviram M Consumption of pomegranate decreases serum oxidative stress and

- reduces disease activity in patients with active rheumatoid arthritis: a pilot study. *Isr Med Assoc J*. 2011 Aug;13(8):474-9.
23. Rasheed Z, Akhtar N, Haqqi TM. Pomegranate extract inhibits the interleukin-1 β -induced activation of MKK-3, p38 α -MAPK and transcription factor RUNX-2 in human osteoarthritis chondrocytes-Arthritis Res Ther. 2010;12:195.
 24. Loeser RF, Erickson EA, Long DL. Mitogen-activated protein kinases as therapeutic targets in osteoarthritis. *Curr Opin Rheumatol*. 2008;20:581-6.
 25. Mélanie Spilmont, Laurent Léotoing Marie-Jeanne Davicco, Patrice Lebecque, Elisabeth Miot-Noirault, Paul Pilet, Laurent Rios, Yohann Wittrant and Véronique Coxam Pomegranate Peel Extract Prevents Bone Loss in a Preclinical Model of Osteoporosis and Stimulates Osteoblastic Differentiation in Vitro, *Nutrients* 2015;7(11):9265-9284.
 26. Ropacki SA, Patel SM, Hartman RE. Pomegranate Supplementation Protects against Memory Dysfunction after Heart Surgery: A Pilot Study. *Evid Based Complement Alternat Med* 2013;2013:93240
 27. Opacki SA, Patel SM, Hartman RE. Pomegranate Supplementation Protects against Memory Dysfunction after Heart Surgery: A Pilot Study. *Evid Based Complement Alternat Med* 2013;2013:93240.
 28. Bookheimer SY, Renner BA, Ekstrom A, Li Z, Henning SM, Brown JA, Jones M, Moody T, Small GW. Pomegranate juice augments memory and FMRI activity in middle-aged and older adults with mild memory complaints *Evid Based Complement Alternat Med*. 2013;2013:946298.
 29. Braidy N, Selvaraju S, Essa MM, Vaishnav R, Al-Adawi S, Al-Asmi A, et al. Neuroprotective effects of a variety of Pomegranate Juice extracts against MPTP-induced cytotoxicity and oxidative stress in human primary neurons. *Oxid Med Cell Longev* 2013;2013:685909.
 30. Panchal SK, Ward L, Brown L. Ellagic acid attenuates high-carbohydrate, high-fat diet-induced metabolic syndrome in rats. *Eur J Nutr* 2012.
 31. Gil MI, Tomás-Barberán FA, Hess-Pierce B, Holcroft DM, Kader AA. Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. *J Agric Food Chem*. 2000 Oct;48(10):4581-9.
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