

Original Paper



Pomegranate Worth in Women's Health-a review

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Abstract

Pomegranate, a fruit native to Iran and neighbors with the ancient history, has recently become of great interest due to its various usages as a functional food and nutraceutical source. There are beneficial phytochemicals such as tannins, flavonoids and antioxidants in different parts of plant, whereas medicinal effects have been reported as antimicrobial, anti-diabetic and anticancer. This short review focused on three aspects of effects which influence women health: breast cancer, obesity and beauty.

Key-words: Functional Food, Therapeutics, Beauty, Anticancer, Phytochemical

Introduction

Nowadays, phrases such as functional foods, bioactive compounds, phytochemicals and so on, are common in phytotherapy and complementary medicine. People, also, tend to usage of natural drugs especially medicinal plants. Although some fruits and vegetables eaten as food, in fact they are medicine in concept. Pomegranate is a fruit typically considered as medicinal plant which includes a wide range of phytochemicals reported useful effects for therapeutics (Adams et al., 2010). The unique chemical composition of the pomegranate plant, rich in polyphenols, antioxidants, tannins, useful fatty acids and flavonoids has drawn the attention of many researchers. Polyphenol rich fractions derived from the pomegranate fruit have been studied for their potential chemopreventive and/or anticancer effects in some animal studies (Afaq et al., 2005).

Pomegranate (*Punica granatum* L.), belonging to Punicaceae which its history come back to Bible and Quran, has recently become of great interest to the scientists who interested in pharmaceutical, nutriological and pharmacological research, for finding new drugs because of its multiple bioactivities such as antiviral, anti-neoplastic, anti-diabetic, anti-

diarrheal, hypolipidemic and helminthic effects (Allan, 2004; mirjalili, 2016).

Historically, the pomegranate considered as a symbol of life, longevity, health, femininity, fecundity, knowledge, morality, immortality and spirituality according to the native and local cultures. In the ancient Egyptian culture the pomegranate fruit was a symbol of prosperity and ambition. In Ayurveda, pomegranate was regarded as "a pharmacy into itself". Ancient Indians believed that its bark and roots had anthelmintic properties, as well, the peels had a powerful astringent nature which useful for diarrhea and oral aphthae. In ancient Greek medicine, pomegranate flowers considered as a useful treat for diabetes type 2. Some documents indicates modern uses of pomegranate derived products applied for treatment of acquired immune deficiency syndrome (AIDS), as well uses in different branch of therapeutics such as cosmetic beautification and enhancement, hormone replacement therapy, resolution of allergic symptoms, cardiovascular prevention, oral hygiene treats, in addition to production of ophthalmic ointment and weight loss soap (Al-Muammar and Khan, 2012).

The objective of the article is introducing a fruit crop which include many useful components and/or

phytochemicals interested in phytotherapy. As well, it attributes some functional role of pomegranate components in human health especially in women.

Material and methods

The data sources EMBASE, Scopus, PubMed, Web of Science, Google Scholar, and IranMedex databases were searched up to July 2017 for studies investigating pomegranate effects. The search terms were “pomegranate”, “health”, “beauty”, “obesity”, “constituents”, “therapeutics”, “anticancer” and “nutraceutical” limited to women. All of the human studies and animal studies with the key mode of action were included. The reference lists of articles were also reviewed for additional relevant studies. Totally, 101 of papers selected for the more studies and preparation the manuscript.

Results and Discussion

Findings in search engines showed increasing interest of scientists on pomegranate. There were over 30400 article about pomegranate documented in Google scholar from 2010 to now. Searching by "pomegranate extract" showed 17000 documents during that years. In PUBMED, the phrase "pomegranate" resulted in 1233 documents during 2010 to 2017. Of these, 926 published in recent last four years. During the time, 72 review were published with the topic of pomegranate. Only in 2017, 12 reviews related to pomegranate published in PUBMED.

By focusing on the subject of the article, plenty of documents found related to health and medication that explained in Table 1.

Pomegranate constituents

Pomegranate, Iran's native plant has recently drawn great interest due to its reported benefits in nutrition and pharmacy. Nowadays, different parts of pomegranate tree use as functional foods ingredients and dietary supplements due to having bioactive compounds such as polyphenols, anthocyanin, conjugates fatty acids and so on; therefore, various medicinal effects have been reported as antioxidant, anti-inflammatory, anti-diabetic and anticancer (Adams et al., 2010). The traditional importance of pomegranate as a medicinal plant is now being reinforced by many new discoveries have been made

in this fruit crop with the advanced technologies demonstrated the fruit contains significant therapeutic properties (Arikawa and Gallaher, 2008).

New chemical analyzers, such as electron spin resonance (ESR), mass spectroscopy (MS), diode array detection (DAD), thin layer chromatography (TLC), nuclear magnetic resonance (NMR), high pressure liquid chromatography (HPLC) and fluorescence detection (FD) increased detected new ingredients in different parts and cultivars of pomegranate. Pomegranate is a rich source of many phenolic compounds including flavanoids (anthocyanins, catechins and other complex flavanoids) and hydrolyzable tannins (punicalin, pedunculagin, punicalagin, gallagic and ellagic acid esters of glucose), which account for 92% of its antioxidant activity (Arikawa and Gallaher, 2008; Mirjalili, 2015a; Wu and Tian, 2017). A comprehensive list of the most important constituents reported by Mirjalili (2015a) showed in Table 2.

Pomegranate effects

Various parts of a pomegranate tree and fruit have therapeutic effects, but I focus on its effects as three aspects: breast cancer, beauty and obesity.

a) *Breast cancer*

Carcinogenesis is a complicated disease known by unlimited cell proliferation with numerous possible causes. Among these, heritage, eating habits, lifestyle, viral infections, mutagenic agents and radiation are of more importance. Studies showed that only 5-10% of all cancers resulted from one or more inherited gene mutations. Therefore, most researchers localized more on presenting fitness in lifestyle and dietary habits for prevention rather than treatment (DiMarco-Crook and Xiao, 2015; Key et al., 2004).

Steward and Brown (2013) stated that a cancer is a multistage process and classify it to three main steps including initiation, promotion and progression (Steward and Brown, 2013). Some authors believed that primary prevention in chemoprevention inhibit mutagenesis and has more effects on cancer initiation. Consumption of fruits and vegetables rich in polyphenols decreases risk factors of cancer (Mocanu, 2015). Some suggested changes in lifestyle could be result in prevention of cancer (Barnard, 2004). In fact, it is accepted that natural products can inhibit cancer, as about 47% of anticancer drugs

Table 1. Some reports found on pomegranate therapeutic effects.

Area of study	Resulted effects	Pomegranate part	References
Antitumor	Inhibition of cell proliferation and invasion	Peels, juice, and seeds	Afaq et al., 2005; Lansky et al., 2005a, 2005b; Lansky and Newman 2007; Syed et al., 2007; Hong et al., 2008; Hamad and Al-Momene 2009; Kim et al., 2002; Seeram et al., 2005b; Fjaeraa and Nanberg, 2009;
Anti-inflammatory	Prevention, inhibition, limiting neutrophil activation and lipid peroxidation; decrease in prostaglandin E2 (PGE2) levels	Extracts, seed oil	Lansky and Newman 2007; Shukla et al., 2008; Larrosa et al., 2010; Lee et al., 2010; Boussetta et al., 2009; Jung et al., 2006; Ahmed et al., 2005; Romier-Crouzet et al., 2009
Obesity	Prevention, inhibition of fatty acid synthesis	Leaf, flower, peel extracts	Lei et al., 2007; Xu et al., 2009; Vroegrijk et al., 2011; al muammar and Khan, 2012; Zou et al., 2014; González-Ortiz et al., 2011; Neyrinck et al., 2013; Wu et al., 2013; Jurenka, 2008
Skin health	Keratinocyte proliferation; inhibition of the proliferation of melanocytes and melanin synthesis; protection against UVA and UVB	Seed oil, fermented juice, peel, seed cake, extracts	Aslam et al., 2006; Pacheco-Palencia et al., 2008; Afaq et al., 2009; Yoshimura et al., 2005; Syed et al., 2006;
Antimicrobial properties	Inhibitors, growth reducers, or even inactivators; preservatives	Extracts	Duman et al., 2009; Pasha et al., 2009; Voravuthikunchai et al., 2004; Gould et al., 2009; McCarrell et al., 2008; Salgado et al., 2009
Oral health	Anti-plaque; inhibition of salivary α -amylase	Extracts, flavonoids, condense juice	Di Silvestro et al., 2009; Vasconcelos et al., 2003; Bielli and Calabrese, 2002, Kandra et al., 2004; Badria and Zidan, 2004; Li et al., 2005;
Anti-diabetic	Hyperlipidemia, pancreatic cells lipid peroxidation; lowering circulating lipids; alpha-glucosidase inhibitor, improving postprandial hyperglycemia and lipid profiles	Flower, peel, juice, extracts	Baliga et al., 2013; Bagri et al., 2009; Huang et al., 2005a; Huang et al., 2005b; Li et al., 2005; Xu et al., 2009; Parmar and Kar, 2007; Parmar and Kar, 2008; McFarlin et al., 2009; Jelodar et al., 2007; Esmailzadeh et al., 2004, 2006; Li et al., 2008

Table 2. Constituents of various part of pomegranate plant.

Peel	Juice	Bark of stem and root	Flower	Leaf	seed
Gallic acid	Sugars	Ellagitannins	Gallic acid	Carbohydrates	3,3'-Di-O- methylellagic acid
Ellagic acid	Aliphatic acids	Piperidine alkaloids	Ursolic acid	Reducing sugars	3,3',4'-Tri-O- methylellagic acid
Punicaline	Gallic acid	Pyrolidins alkaloids	Triterpenoids	Sterols	Punicic acid
Punicalagine	Ellagic acid	Pelletierin alkaloids	Fatty acids	Saponins	Oleic acid
Caffeic acid	Quinic acid			Flavonoids	Palmitic acid
Ellagitannins	Flavonols			Tannins	Stearic acid
Pelletierin alkaloids	Amino acids			Piperidine alkaloids	Linoleic acid
Luteolin	Minerals			Flavons	sterols
Kaempferol	EGCG			Glycosides	Tocopherols
quercetine	Ascorbic acid			Ellagitannins	Sex steroids

available in market are natural products (Newman and Cragg, 2007).

Breast cancer is the most common women's in all countries. It is the leading cause of cancer accounting for 450000 deaths per year (Mocanu, 2015). Breast cancer is increasing worldwide, but the greatest growth shown in Asian region (Banihani et al., 2013). Its heterogeneity from one to another patient is caused difficulty of treatment. Despite of this and unlike other cancers, breast cancer could be treated if detected at an early stage (Begun and Kumar, 2015). Family history of breast cancer, older age, early age at menarche, late age of menopause, long-term use of estrogen-replacement therapy and later age at birth of first-born child are of importance risk factors for breast cancer (Mocanu, 2015). Steroid hormones, particularly estrogens, are the most important factor in the development of breast cancer (Folkerd and Dowsett, 2010).

Several studies demonstrated that dietary natural products could be an effective method for prevention

and treatment of cancers (Trujillo et al., 2017). Fruits and vegetables due to having fiber, vitamins, and bioactive compounds especially antioxidants reduce risk pathogenesis of breast cancer (Farvid et al., 2016). An antioxidant is a substance that reduces damage of oxygen formed by different mechanisms in the body by free radicals. Antioxidant are common in fruits and vegetables, but vary in quantity, fractions and structure in them; by the way, they have specific interactions with oxidants. As well, pomegranate has many various metabolites plays as antioxidants.

Breast cancer classified as one of cancers class take place in hormone-sensitive tissues (Folkerd and Dowsett, 2010). Studies in mice and rat detected crucial role of steroid hormones in breast cancer. Progesterone and 17 β -oestradiol have fundamental role in the management of the cancer. It is believed that estrogen induces carcinogenesis and grows estrogen-responsive tumors. The role of aromatase enzyme for converting androgen to estrogen isn't venial (Briskin, 2013).

In premenopausal women, steroid hormones of ovary synthesize in theca cells. It is believed that estrogen induces carcinogenesis and grows estrogen-responsive tumors. The role of aromatase enzyme for converting androgen to estrogen isn't venial (Briskin, 2013). In premenopausal women increases the risk of breast cancer. Changes in sex hormones i.e. decrease in SHBG (Sex hormone-binding globulin) and increase in estrogens estrone (E1) and estradiol (E2) enhance the risk. Diet can strongly affects physiology of the body especially hormones secretion. Some diets can reduce estrogen synthesis in these women have potential for preventing breast cancer (Begum and Kumar, 2015).

Scientists found pomegranate-derived substances such as ellagic acid, gallic acid, and urolithins A and B able to suppress aromatase activity. Of them, Urolithin B is more effective for inhibiting it (Chidambara et al., 2002). Begum and Kumar (2015) evaluated cytotoxic effect of spiny pomegranate (*Punica granatum* L. var. *spinosa*) extracts on breast cancer cell line (MCF-7). Their results showed concentration dependent reduction in cancer cells, as they concluded methanolic pomegranate fruit peel extract had more effects on cancer cells than pomegranate seed extract. Another research showed that pomegranate extracts and genistein affect MCF-7 cancer cells by dose and time dependent via cytotoxic and growth inhibition effects (Jenu et al., 2005).

In addition to, pomegranate peel rich in ellagitannins, seeds of the fruit containing linolenic acid isomers that can affect activity of estrogen receptor. In fact, it is demonstrated that bioactive compounds found in pomegranate by affecting on the three crucial enzyme (aromatase, cyclooxygenase, 17 β -hydroxysteroid dehydrogenase) cause prevention strategies on proliferation and developing breast cancer (De Kok et al., 2010; Folkerd and Dowsett, 2010).

In an in vitro assay documented that polyphenols from fermented juice, aqueous pericarp extract and seed oil inhibited aromatase and 17 β -hydroxysteroid dehydrogenase activities. It concluded that inhibition of breast cancer cell lines by fermented juice and pericarp polyphenols of pomegranate were more due to estrogen-dependent (MCF-7) than estrogen-dependent (MB-MDA-231), as the anti-proliferative effect of fermented juice assessed above twice than fresh juice of pomegranate (Kim et al.,

2002). Kim and colleagues also indicated that pomegranate seed oil suppressed proliferation of MCF-7. It is clear that polyphenols found in the fermented juice and pericarp are antioxidant potent for suppressing the biosynthesis of 17 β -estradiol, whereas oils derivatives inhibitor of E2 biosynthesis catalyzed by 17 β -hydroxysteroid dehydrogenase. The oil strongly inhibited cyclooxygenase lead to prevention of breast cancer cell proliferation and invasion and carcinogen-induced development of mammary alveolar lesions (Kim et al., 2002).

Some authors believed that various form of pomegranate products exert their effects on tumors, proliferation and inflammation by correlated multiple signaling pathways (Sharma et al., 2017). In the last valuable report, Sharma and colleagues (2017) stated that pomegranate affect breast cancer by anti-estrogenic and anti-aromatase activities effects, down-regulating estrogen responsive genes and genes modulated inexpression of DNA damage and repair, reducing vascular endothelial growth factor and pro-inflammatory cytokines and finally by disrupting ER and Wnt/ β -caterin signaling pathways.

b) Obesity

Obesity is the most common metabolic disease important health concerns facing our society today in developed countries. According to World Health Organization it has become a global epidemic in recent years (Hönn and Göz, 2007). It is of importance due to associated with a variety of chronic diseases such as hyperlipidemia, diabetes mellitus, hypertension coronary artery disease and certain cancers. Furthermore, obesity, especially abdominal obesity, has an association with dyslipidemia characterized by increasing triglyceride (TG) and decreasing high-density lipoprotein cholesterol (HDL-C) concentrations (Hora et al., 2003).

Obesity and overweight can resulted in various diseases. Weight loss in obese persons at any age can decrease the obesity-related medical complications and increase physical function and quality of life. Diets and Lifestyle interventions, pharmacotherapy, and surgery are the most common approaches for weight management (Hsu et al., 2007).

Increasing demands as well as low efficiency and undesired side effects of drugs and methods, resulted in little success in anti-obesity drug development (Hursel and Westerterp-Plantenga,

2010). Although weight-loss procedures by surgery are on the rise, because of rapid and ease in practice, but nutritional deficiencies of micronutrients and macronutrients take places after it, acquainted suppliants against complication; however, the prevalence and severity of the method depends on the type of surgery (Johanningsmeier and Harris, 2011).

Findings in a study showed correlation between adult obesity and premature death; as for women, a 7-years decrease in life expectancy have been reported (Peeters et al., 2003).

Obesity is a result of an energy imbalance, where energy intake is greater than energy consumption. The prevention and treatment of the imbalance requires adjustments not only physical fitness obtained by lifestyle but also try for elevating intake of natural foods that help improve energy expenditure by stimulating thermogenesis and fat oxidation (Kasai et al., 2006; Key et al., 2004).

Fruits and vegetables, often have highly fibers with low calories. Also, many natural products such as crude extracts and bioactive compounds isolated from plants, can stimulate decreasing body weight and prevent diet-induced obesity. Pomegranate and its components which known as natural and organic fruit, has many advantages for the consideration (Kim et al., 2002).

Pomegranate extract comprises various abundant phytochemicals. Anthocyanins (such as delphinidin, cyanidin and pelargonidin) found in its juice and hydrolysable tannins (such as punicalin, pedunculagin, punicalagin, gallagic acid, ellagic acid and its esters of glucose) isolated from fruit peel have strong antioxidant and anti-inflammatory properties. They are able to divulge anti-tumor effects causes by many chemical carcinogens surveyed both in vivo and in vitro experiments (Kohno et al., 2004; Langley, 2000; Lansky and Newman, 2007; Lei et al., 2007; Masaud et al., 2014).

In obese mice, pomegranate leaf extract (PLE) suppressed extension of obesity and hyperlipidemia, despite of high-fat regime (Mirjalili, 2016; Lei et al., 2007). Authors believed that these effects occurred due to both arresting pancreatic lipase activity and impeding energy intake. They suggested that PLE could be an appetite blocking under consideration. Lei et al., (2007) concluded that PLE had an effective material against obesity induced by diet. Oral medication of PLE at the level of 800 mg/kg play down fundamental risk factor for dyslipidemia

included body weight, lee's index, serum TC, TG, glucose levels and TC/HDL-C ratio. It reduced dyslipidemia as decrease in percentage of abdominal fat pad weight and serum triglycerides level.

Other investigations about mode of action demonstrated that Pomegranate ingredients cause increasing in weight loss, fat oxidation and total antioxidant contents, as well as decreasing in serum cholesterol, lipid peroxidation, serum glucose and insulin, body fat, abdominal fat, oxidation stress, HDL-cholesterol, cholesterol: HDL cholesterol ratio. These result in protection and prevention against obesity, diabetes, cardiovascular diseases, hypertension, hypercholesterolemia, and high fat diet (Mirjalili, 2015a).

In a new recently findings on ellagic acid isolated from fruits including pomegranate, have been identified suppressive roles of ellagic acid on increasing in fat cell size or fat cell formation resulted in adipocyte expansion. Anti-lipogenetic effects of ellagic acid caused by impeding de novo lipogenesis of fatty acids in ripe adipocytes, have been demonstrated in Huh7 cells. Also, ellagic acid can convert triglyceride storage via increasing β -oxidation, suggested lowering triglyceride level in liver and adipose tissues. Finally, authors concluded that ellagic acid can considered potentially as a dietary factor for maceration (Kang, 2015).

Hora and colleagues (2003) demonstrated suppressive effects of polyphenols isolated from pomegranate seed oil and fermented juice. They reported, also, inhibiting properties and anti-proliferation and anti-invasive effects of seed oil in mouse mammary organ culture (Hora et al., 2003). Pomegranate is one of the rarest plants contain conjugated fatty acids. Punicic acid as a fundamental ingredients of it, has cytotoxic effects to mouse leukemia cells due to prevention of lipid peroxidation (Hora et al., 2003).

c) *Beauty*

Although the ideal of beauty is innate, but the main factor defining an individual's attractiveness is face characteristics. An attractive appearance has a definite influence on daily life. Indeed, beautiful people are considered friendlier, more intelligent, more interesting, and more socially competent (Paccaud et al., 2000). It is colloquial that "beauty builds confidence and confidence amplifies beauty".

Of course, beauty abstracted not only to face but also to body. A woman who's beautiful is more than just physically attractive. In a world where obesity has reached almost epidemic proportions, the relationship between body weight and beauty in females deserves special attention. Nowadays, the ideal of female beauty has shifted from a symbol of fertility to one of mathematically calculated proportions (Paccaud et al., 2000).

Face status, traditionally, is a good index for beauty especially in women. Acne, redness, black spots, scab, wrinkling etc. are imperfections decreases the beauty. Damage to the skin could be resulted from passing the time (senectitude) and/or premature aging (photoaging) due to external factors (Piccardi and Manissier, 2009). The damage is deteriorated chronically by sun exposed skin. Skin damage correlated by cosmetic issue, but it is also a medical problem. Ulcers are often created by severely damaged to susceptible skin for bruising, then resulted in non-healing ulcers. In diabetic patients, ulcer formation in the lower limbs, is the crucial cause of limb amputations (Sturgeon and Ronnenberg, 2010). In addition to, skin damage usually seen as a consequence of diabetes and long term usage of corticosteroids.

Many documents found on improving beauty and skin health via changing or by supplementing the diet, resulted that some natural products such as vitamins, carotenoids and fatty acids supplements can promote skin condition and impede skin diseases (Piccardi and Manissier, 2009; Boelsma et al., 2001). Moreover, natural products absorb quickly as well as low allergenic especially for skin (Mukherjee et al. 2007). Nowadays, herbal cosmetics have increasing tendency due to their significant effects of skin aging (Mukherjee et al., 2011).

There are a lot of introduced products for eliminating acne, redness and other imperfections in face. Bioactive compounds such as retinoids as topical treatment on skin had considerable effects for photoaged skins (Kafi et al., 2007).

In literature, pomegranate had been known as elixirs for women's health. It reported that balance hormones and beneficial for beauty and fertility. According to the belief and new documents reported about therapeutics, pomegranate introduced as the symbol of medicine for the 2000 UK Millennial Festival of Medicine (Syed et al., 2007). Most popular pomegranate properties largely focused are anti-

oxidant, anti-inflammatory activities. Pomegranate fruit has useful dermal and epidermal activities (Aslam et al., 2006). Pomegranate seed oil included useful fatty acids. It comprised of palmitic, stearic, oleic and linoleic acids and some isomers of linolenic acid; however predominant form of fatty acids is C18:3, mostly punicic acid. A study demonstrated that pomegranate seed oil positively affect health due to high content of conjugated fatty acids especially punicic acid) (Syed et al., 2006). Aslam and colleagues (2006) reported that pomegranate seed oil stimulate keratinocyte proliferation but has no effects on dermal fibroblast function; meanwhile, aqueous extract of pomegranate peel stimulate dermal fibroblast proliferation and collagen synthesis.

Skin care products obtained from different pomegranate parts including extracts, juice and seed oil show off increasingly in markets promising rejuvenation, youthfulness and beauty. However pomegranate potential for cosmeceutical effects was fixed (Syed et al., 2006). In human cell cultures, the seed oil elevated thickness of epidermis as well its peel extract increased fibroblasts number, resulted in dermal repair (Aslam et al., 2006).

There are a lot of ellagitannins especially ellagic acid in pomegranate peel that oral administration resulted in inhibiting UV-irradiated pigmentation suggesting it had a whitening effect on the skin. This effect attributed to inhibition of the proliferation of melanocytes and melanin synthesis by tyrosinase in the melanocytes (Yoshimura et al., 2005).

In another effort showed that oral supplementation with pomegranate extract stimulate protection UV induced pigmentation in human subjects that are prone to sunburn (Tran et al., 2010).

Protective and chemopreventive properties of pomegranate extracts on human skin fibroblasts was described (Pacheco-Palencia et al., 2008). Its polyphenolic ingredients have protective effects against UVA and UVB caused cell death suggested due to inhibiting UVB induced MMP-2 and MMP-9 activities resulting in UVB induced protein expression of c-Fos and phosphorylation of c-Jun (Afagh et al., 2009). Protection against UVA mediated cellular damage also proposed as a photochemopreventive agent (Viurda et al., 2010).

In hormone replacement therapy of women during menopause, it suggested that sex steroids found in pomegranate seed oil could be considered as an alternative medicine (Lansky, 2007). Its

phytosterols as well as polyphenols shown that are useful for wound healing, tempering inflammatory responses, preventing wrinkle formation, reducing redness, and alleviating itchy skin (Xanthakos, 2009).

One of promising properties of pomegranate extracts is anti-diabetic. Pomegranate fractions modulate diabetes malicious by reducing oxidative stress and lipid peroxidation. It suggested that this reduction occur by different pathways such as neutralizing reactive oxygen species, elevation of antioxidant enzyme activities, stimulation of metal chelation activity, fall in resistin formation and effects of transcriptional factors (Paccaud, 2000).

Banihani et al., (2013) showed that fasting blood glucose levels decrease significantly by punical acid, methanolic seed extract, and pomegranate peel extract include punicalagin and ellagic, gallic, oleanolic, ursolic, and uallic acids, have been identified as having anti-diabetic properties (Zaid et al., 2007). Furthermore, the juice sugar fraction was found to have unique antioxidant polyphenols (tannins and anthocyanins), which could be beneficial to control conditions in type 2 diabetes.

Other therapeutics

Some reports there are about treating the infection of sexual organs, mastitis, folliculitis, pile, allergic dermatitis, tympanitis and scald for curing diarrhea and dysentery apart from sexuality (Chidambara et al., 2002). Other medical application of pomegranate fruit against erectile dysfunction (Azadzoi et al., 2005; Loren et al., 2005), carotid occlusion (Aviram et al., 2004) and neonatal ischemia could be found (Aslam et al., 2006).

Conclusion

Pomegranate and its derivatives are rich sources of several chemical compounds with potential physiological activities. To date, clinical trials have shown significant positive effects of pomegranate metabolites on some patients. Regular consumption of pomegranate juice may aid in the prevention or management of some diseases. Pomegranate contains a number of unique ellagitannin-based compounds, including punicalagins, punicalins, and gallagic acid, as well as anthocyanins and a distinct fatty acid profile, all of which may contribute to potential and reported health effects.

Conflict of interest: All authors declare no conflict of interest.

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