

Evaluation Possibilities of Different Parts of Pomegranate, a Historical Fruit and Its Effects on Health

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Abstract. Today, with the faster development of science and technology, people have started to pay more attention to healthy living and consuming foods that are beneficial for human health. In this context, the value given to fruit species has become increasingly important and the importance of plants whose seeds are consumed has increased, as well as colourful fruits and vegetables. Pomegranate is a fruit grown in many countries in the world, especially in the Mediterranean climate, and its economic value has been increasing in recent years. This fruit has gained great nutritional importance not only because of its flavour but also because it contains many antioxidant substances and phenolic compounds that are beneficial to human health. There are nearly fifty pomegranate varieties registered in our country. These pomegranate varieties range from sweet to sour, from small-in size to large in size, and from hard-seeded to soft-seeded in terms of skin colour and fruit colour. In recent years, the use of pomegranate parts such as peel, seeds, and flowers in cosmetics and food industry has become widespread and studies on the antioxidant properties of different parts of pomegranate have attracted interest. The aim of this review is to investigate the health effects of pomegranate fruit, different parts of pomegranate, and products made from pomegranate.

Keywords: Health, Nutrition, Pomegranate, Processing, Türkiye

1 Introduction

Pomegranate (*Punica granatum* L., $2n=2x=16$) is a perennial fruit species belonging to the Lythraceae (synonym: Punicaceae) family that can be grown in temperate, subtropical and tropical regions. In recent morphological [32], molecular [11] and APG IV system [12] studies, the Punicaceae family, which has a genus, is now examined within the Lythraceae family. In ancient Egypt, the pomegranate was called "Arhumani". The ancient Semitic sect was named "Rimmon", derived from names such as "Ramon" in Hebrew and "Rumman" in Arabic. In the Romans, it is stated that this species was named "*Punicum granatum*" from "*Malum punicum*" (*Carthaginian punicum* or apple) in the first development phase. In Central Asia (Afghanistan, etc.), the Near East (Iran, Turkey, etc.) and India, the fruit is often called as "Anar" [25],[92],[19], [39].

The pomegranate fruit is religiously and mythologically sacred, considered a forbidden fruit and a symbol of abundance and prosperity. According to Jewish belief, the pomegranate represents righteousness and honesty. According to another belief, it is believed that pomegranate was the fruit of paradise forbidden to Adam and Eve. In mythology, the pomegranate was considered a sign of being, the eternity of the soul, the richness of nature, the invincibility of heroes and the sign of strength. It has also been used to symbolize the indissolubility of absolute marriage, life and rebirth.

Therefore, the pomegranate is a frequent motif in Christian religious decorative art. The pomegranate fruit is depicted in engraved paintings in places of worship. Pomegranate motifs are frequently found on clerical vestments, religious decorative fabrics hung on walls and metalwork. In our holy book, the Quran, the word pomegranate is mentioned three times: Surah Enam 99 and 141, Surah Rahman 68. In the first two of these, the pomegranate is mentioned as an example of the beautiful things created by Allah, and in the third, it is described as a fruit in paradise [5]. In Buddhism, in addition to being sacred, pomegranate is known as the essence of the positive, beautiful aspects of life and a source of healing that cures disease. In Greek mythology, it represents efficiency, productivity and abundance. In the holy books, it is stated that pomegranate seeds symbolize abundance, sometimes a community and sometimes fertility, and its red color represents blood and savagery [46],[67]. As described above, the pomegranate is mentioned in most of the holy books and is also found in Egyptian, Greek and Roman legends.

Pomegranate is a perennial plant that loves light and can be easily grown anywhere from sea level and up to 1000 m altitude [65]. It is an evergreen or deciduous fruit species in tropical and subtropical climate zones. Pomegranate is a shrub plant that grows 5-8 meters tall and bears fruit. Pomegranate has a very strong and powerful root structure. Frequent branching occurs in

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the plant and it is multi-stemmed. Flowers are hermaphrodite and male-female. Pomegranate has two types of flowers. The sepals of the first type of flower are cylindrical and large. This type of flower is in the shape of a small pomegranate fruit and it is these flowers that provide fruit formation in pomegranate. The second type of flowers are unproductive or abortive flowers. They do not form fruit [21]. Fruits are round spherical, slightly flattened and large. The flowers of the pomegranate plant are dioecious, orange-red in color and have a very bright appearance. The sepal ring is tubular, divided into 5-7 segments; the petals appear lanceolate in the sepal ring. Non-climacteric pomegranate fruits with low respiration rate are usually harvested when fully ripe. Pomegranate fruits are covered with a leathery pericarp (skin). The pericarp color varies from yellow-green to dark red. The inside of the fruit is divided into compartments with membranous walls and white spongy tissues. Each compartment contains a transparent cavity filled with fleshy, juicy, red, pink or whitish soft pulp called arils. The homeland of the pomegranate is thought to cover the regions between the South Caucasus, Iran, Afghanistan, South Asia, Western Asia, Anatolia and the Mediterranean. In addition to its homeland, it is also cultivated in the Mediterranean coastal regions of Europe and Africa, China, India, Afghanistan, Iran, Arabia, Chile, Argentina, California, Arizona and Northern Mexico [21],[46],[67]. Pomegranate, which is cultivated in seven continents, is mostly grown in India, Iran, Turkey, USA, Tunisia, Spain, Syria, Pakistan, Morocco, Egypt, Georgia, Azerbaijan and Uzbekistan. The most important pomegranate varieties grown commercially in these countries are Ganesh in India, Schahvar and Robab in Iran, Hicaznar and Beynar in Turkey, Wonderful in the California region of the USA and in Israel, Zehri and Gabsi in Tunisia, and Mollar and Tendral in Spain [24]. The harvest period of pomegranate fruit lasts from August to November in the northern hemisphere and from March to May in the southern hemisphere [75]. Although there are more than 500 pomegranate varieties worldwide, only 50 of them are grown as commercial varieties. The countries that produce the most pomegranate in the world are India, Iran, China and Turkey [46], [31]. Today, official statistics kept regularly by the Food and Agriculture Organization of the United Nations and the European Statistical Office FAO and EUROSTAT are not yet available [24]. India ranks first in pomegranate production in the world with 1.789.310 tons. Iran ranks second with 1.000.000 tons, China ranks third with 800.000 tons, and Turkey ranks fourth with 681,460 tons [22]. In the last decade, Turkey's pomegranate production area increased from 269.024 decares to 290.697 decares, the number of fruit-bearing trees increased from 10.011.871 to 14.133.177 and the amount of pomegranate production increased from 315.150 tons to 681.460 tons with an increase of 46.2% (Table 1.1 and 1.2) [4].

Pomegranate, the symbol of fertility and abundance in different cultures, is among the first plants cultivated in the world. Pomegranate fruit, which is in the Punicaceae family; It is a fruit with very different characteristics that

has come to the fore with its mystical properties since ancient times. Since Turkey is one of the gene centers of pomegranate, our country has extremely rich pomegranate genetic resources.

Table 1.1 Pomegranate production area and production amount in Turkey by years

Years	Production area (Decare)	Number of fruit-bearing trees	Production quantity (tons)
2012	269.024	10.011.871	315.150
2013	283.991	11.086.789	383.085
2014	304.548	11.755.997	397.335
2015	307.511	13.310.323	445.750
2016	305.302	13.858.784	465.200
2017	297.667	13.661.560	502.606
2018	291.490	13.574.229	537.847
2019	285.253	13.739.341	559.171
2020	284.632	13.670.173	600.021
2021	292.013	14.127.578	647.676
2022	290.697	14.133.177	681.460

Table 1.2 Pomegranate production by province in 2022

Local	Giver Number of Trees	Fruitless Number of Trees	Production Amount (tons)
Antalya	3015233	266693	173058
Mersin	1866157	100274	102690
Adana	1085404	148596	88231
Muğla	1474443	95756	71374
Denizli	1339009	206751	52450
Adıyaman	822822	418134	43987
Hatay	833481	47383	29381
Gaziantep	613539	51045	26884
İzmir	471844	55469	18532
Aydın	431515	88553	16371
Şanlıurfa	540960	145053	8749
Siirt	192793	36315	6143
	Collective Fruiting Area (Decare)	Yield (kg)	
Antalya	63018	57	
Mersin	39309	55	
Adana	23872	81	
Muğla	22771	48	
Denizli	23698	39	
Adıyaman	18240	53	
Hatay	13014	35	
Gaziantep	17254	44	
İzmir	6710	39	
Aydın	9025	38	
Şanlıurfa	13338	16	
Siirt	10054	32	

There are nearly fifty pomegranate varieties registered in our country. Variety selection is very important in pomegranate cultivation. Varieties should be adapted to the climate of that region, resistant to diseases, have good yields, fruits should be suitable for people's taste and taste and resistant to transportation. In variety selection, it should be decided to grow table or industrial varieties according to the commercial purpose. The most

widely cultivated variety in our country is Hicaznar. This variety has gained popularity in European countries due to its red skin, dark red grains and sour taste. The abundant yield of this variety also reveals its superiority with its suitability for preservation and transportation [80]. In particular, the Hijaz pomegranate variety sent from Turkey has been very popular in European countries, creating a "Turkish Pomegranate" image and selling for twice the price of pomegranates from other countries. Pomegranate exports from Turkey are also made to Russia and some Far Eastern countries as new markets [5].

When the pomegranate cultivation regions of Türkiye are analyzed, the Mediterranean, Southeastern Anatolia and Aegean regions have the highest production and sweet, sour, sour, early, middle and late varieties suitable for these regions have been identified. In addition, Göksu Valley in Karaman and Sakarya Valley in Bilecik and Eskişehir are important pomegranate production areas with microclimate characteristics. According to TURKSTAT data, pomegranate cultivation is practiced in 59 provinces. According to 2022 data, Antalya ranks first with 173.058 tons of pomegranate production, accounting for 69.6% of the total production of 402.635 tons in the Mediterranean Region and 25.3% of the total production in Turkey, followed by Mersin (102.690 tons), Adana (88.231 tons), Muğla (71.374 tons), Denizli (52.450 tons) and Adıyaman (43.987 tons) [4]. We can say that there has been a rapid increase in the amount of pomegranate production in our country in recent years. The reasons for this are; its use as a raw material in the pharmaceutical industry, the fact that it has become a fruit that is more recognized and interested in its cultivation as a result of developments in food technology, storage and transportation, and the rapid increase in demand for pomegranate and pomegranate products with the discovery of the positive and therapeutic properties of pomegranate on human health in recent years.

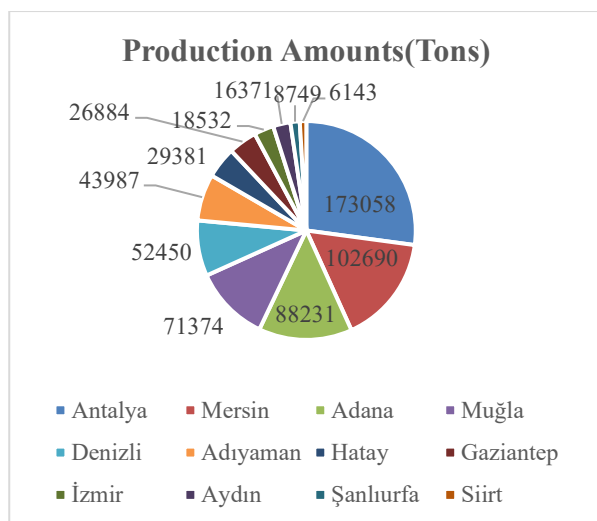


Figure 1. Pomegranate production in 2022

In recent years, pomegranate has reached an important position in the world food agenda thanks to the commercial importance of its juice and its increasing popularity from fresh consumption. Thanks to this commercial importance, studies on pomegranate have increased, pomegranate cultivation technique, food technology, usage possibilities, storage conditions and suitability for storage, suitability for transportation to the market and methods have been the subject of scientific studies. Pomegranate fruit and plant is an industrial plant because it is used as raw material during the production of various products. In recent years, significant increases have been recorded in the export area. Pomegranate seems to be a candidate to be among the products that will be consumed a lot in the future with the change in the order of priority in our country and in the world [90]. Changes and awareness in the dietary patterns of consumers have led to an increase in the preference of pomegranate by consumers in recent years and an increase in production in parallel with the increase in demand due to consumption all over the world [38].

1.2 Importance of Pomegranate in Terms Of Phenolic Substances

Today, pomegranate has been included in the class of foods used for AIDS and is one of the nine plants included in Japanese patented medicines. The flavonoids contained in pomegranate have been found to be a powerful antioxidant. Pomegranate fruit juice and oil have been reported to prolong life and prevent heart disease and cancer [48]. In the last few years, studies have indicated the potential health effects of pomegranate as an important factor, which has increased its popularity and consumption [63]. Pomegranate is a fruit rich in polyphenolic substances, antioxidants, alkaloids, vitamin C, flavonoids and resinous substances. For this reason, it can be consumed against diseases such as cancer and heart diseases. In addition, it has been scientifically proven that it is good for constipation, diarrhea prevention, heartburn prevention, cough suppression. According to recent studies, some of the compounds it contains may have protective properties in the fight against Parkinson's and Alzheimer's diseases. The popularity of pomegranate, which has many positive effects on health such as eliminating the damage of free radicals in the tissues due to its high antioxidant capacity and phenolic content and thus reducing the risk of many diseases such as cancer, cardiovascular diseases, is increasing [79],[70]. Pomegranate has been widely used by different civilizations for thousands of years for therapeutic purposes [10]. Pomegranate also angiogenesis and metastasis by reducing the level of vascular endothelial growth factor (VEGF) plays an important role in prevention [83]. When the antioxidant balance in the human body develops in favor of oxidants due to different reasons (environmental pollution, fatigue, aging, excessive calorie intake and high fat diets), the body needs antioxidants. Since the antioxidant effect of phenolic compounds reduces the oxidative process, they play an important role in controlling oxidative changes in both the human body and food systems [74]. In recent

years, due to the indiscriminate use of antibiotics and the resistance of human pathogenic bacteria to drugs, interest in phenolic compounds with antioxidant and antimicrobial effects has increased. It has been determined in different studies that these compounds inhibit the growth of various bacteria and mold species in the environment and can prevent various infectious diseases that may be caused by these microorganisms and may be effective in the control of pathogens. It is reported that phenolic compounds found in all parts of plants at different levels inhibit different enzymes and have anti-allergen, anti-mutagen, anti-carcinogen, anti-glycemic, anti-cholesterol, anti-inflammatory, anti-thrombotic, vasodilator and sedative properties [86], [76]. In studies, it has been reported that the risk of coronary heart disease decreases in individuals who include foods with high phenolic content in their diets [77]. In *in vitro* studies, it has been emphasized that plant phenolics play an important role in anti-diabetic effects due to their ability to inhibit enzymes involved in carbohydrate breakdown, anti-inflammatory activities due to their capacity to inhibit LOX [82] and anti-cancer effects due to their high cytotoxic effects [45].

1.3 Common Uses of Pomegranate

For centuries, pomegranate has been the subject of various branches of art due to its fruit, shape, structure and some of its properties, and its fruits, roots, stems, leaves and flowers have been used frequently. However, it is also important for the economy of our country that pomegranate is processed in the food industry and marketed at home and abroad as various value-added products, especially commercial pomegranate juice. In parallel with the rapidly growing and developing pomegranate juice and other pomegranate products processing industries, a significant amount of pomegranate waste and by-products are also produced. In our country, which has an important place in pomegranate production, there is a need for research to determine the evaluation methods of such products, which have economic value and whose positive effects on health have been revealed by scientific studies in parallel with the development of nutritional awareness. Root, stem, flower and fruit of pomegranate are used for various purposes. Pomegranate fruit consists of three parts: seed, water and peel. The edible part, in the kernels, constitutes 52% of the fruit and 78% of the kernels consist of fruit flesh and 22% of the kernels [44]. In addition to its high nutritional properties due to the bioactive components it contains, its ethnobotanical effects increase its commercial value. It is also used as a refreshing additive in various drinks. The roots, stems, twigs, bark, seeds and fruits of the pomegranate tree contain starch, mannitol, punicin, anthocyanin, polyphenolic, isopelletier alkaloids, methylpelletier, triterpenes, resinous substances, acids, tannins and alkaloids. The range of products in which pomegranate is used as grain, peel or seed is very wide. In our country, apart from fresh consumption, pomegranate is utilized in various industries such as pomegranate juice, pomegranate concentrate, pomegranate sour,

pomegranate wine, pomegranate liqueur, pomegranate soda, canned grains, dried pomegranate seeds, jam, syrup and pomegranate molasses. Pomegranate syrup is frequently used in kitchens to flavor some dishes and especially salads; although its traditional production is a common practice in our country, in recent years, industrially produced pomegranate syrup sauces are also sold commercially. Vegetable oil is produced from pomegranate seeds and knitted baskets and molds are made from the glutinous branches. It can also be used as a coloring and flavoring agent in various foods. In India, a type of snack called "anardana" is made by drying wild pomegranate seeds. In France, pomegranate juice is used in the production of an alcoholic beverage called "grenadine". In Middle Eastern countries, the sauce obtained by drying sour pomegranate seeds is used in meals [57], [18], [17]. In addition to being consumed fresh, pomegranate can be consumed in many ways due to its long-term preservation. Pomegranate fruit is used for table consumption, sour pomegranates are used in citric acid production and vinegar production, and pomegranate seeds, which are a by-product of pomegranate juice production, are used in the production of vegetable oil and nutrient flour for animal feeds. The tannin (28-30%) contained in the peels is used especially in fabric and leather dyeing in the leather processing industry and in the clarification of fruit juices. Pomegranate peels and flowers are raw materials used in dye and ink production.

1.4 Pomegranate fruit

The chemical composition of pomegranate fruit varies according to the growing region, climate, variety, planting practice and storage conditions. Depending on its chemical composition, pomegranate juices are used for fresh consumption, industrial production or medicinal purposes. It has been reported that pomegranate contains many phenolic compounds in its seed and peel as well as its juice, that these components can pass into the juice in significant amounts and that punicalagin has the highest antioxidant activity among these components. Some chemical compounds found in various parts of pomegranate such as fruit, leaf, flower, root and peel play an important role in the treatment of many diseases. Pomegranate can stop cough, heartburn, constipation, diarrhea and vomiting, strengthen the body and heart, relieve some pains in the body, diuretic, very useful for throat, chest and lungs, has blood pressure and fever reducing effect, has preventive effect on vascular occlusion, protects cells against auto oxidation damages, It is reported to be able to maintain the level of glucose in the blood, contribute to the formation of some of the proteins and peptides, prevent inflammation of bone joints, cause positive changes in blood parameters, liquefy the blood, lower cholesterol, increase a special prostate antigen, be effective in reducing kidney stones, help in the treatment of heart disease and Alzheimer's. In the last decade, pomegranate fruit and fruit extracts have been shown to have preventive and debilitating effects against many chronic and health/life-threatening diseases such as cancer [64], type 2 diabetes [9], atherosclerosis and cardiovascular diseases [7].

Pomegranate fruit and juice have special cooling and digestive effects. It has also been stated that the interest in this fruit will increase in the coming years due to its antimicrobial, anticarcinogenic, antiparasitic and antiviral properties [34], [1], [33].

1.5 Pomegranate Juice

The consumption and marketing of pomegranate juice is increasing rapidly worldwide and pomegranate is one of the most popular functional foods. In addition, the use of pomegranate juice or its derivatives as a coloring and flavor enhancer in foodstuffs has led to an increase in pomegranate production [2]. Pomegranate juice is known to have high antioxidant capacity due to delphinidin, cyanidin, pelargonidin, ellagatins and punicalagin. The most abundant phenolic acids in pomegranate juice are coumaric acid, chlorogenic acid, ferulic acid, gallic acid, ellagic acid, protocatechic acid and caffeic acid. Due to the antioxidant effect of phenolic compounds in pomegranate juice, it is stated that they prevent many important and common diseases, including cancer, diabetes and cardiovascular diseases, and delay aging [84], [27],[40]. In addition, the interest in pomegranate and pomegranate products is increasing day by day by both consumers and researchers due to their positive effects on health such as the prevention and treatment of disorders and diseases such as diabetes, Alzheimer's disease, arthritis and colitis [30], [85]. It has been reported that pomegranate juice shows cancer-chemopreventive and cancer-chemotherapeutic effects against prostate cancer [54] and pomegranate juice consumption is even recommended in the treatment of AIDS [50]. Considering its antioxidant, anti-inflammatory and anti-infective activities, the inedible part of the pomegranate fruit is thought to be more nutraceutically active than pomegranate juice. Considering these properties, the peel and seed parts of pomegranate fruit, which have been used in many fields such as medicine, paint and cosmetics since ancient times, are gaining importance in the pharmaceutical, food and cosmetic industries as an important additive due to their rich antioxidant and phenolic compound content [73], [49], [61], [14]. The inhibitory effect of pomegranate juice on *Staphylococcus epidermidis* and *Klebsiella pneumoniae* bacteria has been demonstrated, showing that pomegranate has antibacterial activity. According to one study, the antibacterial activity of pomegranate juice was attributed to phenolic compounds, pigments and citric acid. Fresh pomegranate fruit peel extract was also found to be effective as an antifungal agent against *Candida albicans*. The antiviral activity of pomegranate has been attributed to the tannins it contains. In a study, it was shown that pomegranate juice can prevent HIV-1 entry into cells [55]. Pomegranate juice is reported to have antitumor [15], antimicrobial [78], antiatherosclerotic [6] and anti-inflammatory [35] effects. Pomegranate juice has been used since ancient times as a natural astrengen against diarrhea and harmful internal parasites [16]. Thanks to its bioactive components, pomegranate has been used in traditional treatment methods for centuries [51]. The juice of wild pomegranates is

utilized to obtain citric acid and sodium citrate for pharmaceutical purposes. Pomegranate juice is included in the composition of preparations used in the treatment of dyspepsia. Pomegranate juice is also thought to be useful in the treatment of leprosy. Researchers have also reported that pomegranate juice not only prevents hardening of the arteries by reducing damage to blood vessels, but the antioxidant-rich juice can prevent the progression of this disease. Recent studies have shown that pomegranate juice shows a high amount of antioxidant activity. The high antioxidant capacity and rich phenolic content of pomegranate fruit and its positive effects on health are thought to be transferable from pomegranate fruit to fruit juice and even to other products made from pomegranate, such as pomegranate liqueur.

1.6 Pomegranate Peel

It has been reported that pomegranate peel extract has strong antiviral and antimicrobial effects; conjugated linoleic acid in pomegranate seed oil reduces the risk of colon cancer and atherosclerosis in experimental animals and has positive effects on the immune system. It has also been emphasized that consumption of pomegranate juice helps in the treatment of AIDS (Acquired Immune Deficiency 11 Syndrome) disease [58], [37], [52], [20], [26], [13], [23], [81]. The rich tannin found in pomegranate peel is used extensively in the leather processing industry and in the clarification of fruit juices and in the prevention of zinc poisoning. In addition, pomegranate peel and flowers are used in the production of paint and ink. Pomegranate seeds contain the same amount of oil as cotton seeds. The pulp left over from the oil industry is the richest plant source containing estrogen hormone. In the study conducted [28], it was determined that the hydroalcoholic extract obtained from pomegranate peel was effective against dermatophyte fungi (causing infection of skin, hair and nails) such as *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Microsporum canis* and *Microsporum gypseum*. The study also emphasized that punicalagin is the main active ingredient against these fungi. As a result of the study, it was stated that pomegranate may be a therapeutic/healing alternative for use as an antifungal in skin infections. [66] stated in their study that pomegranate peels can be used as a source of proanthocyanidins and quercetol both in pharmacy and other fields. The bark and roots of the pomegranate tree contain "isopelletierine", an alkaloid effective against intestinal worms. Depending on the tannin content, pomegranate tree bark, leaves, raw fruit and fruit peel extracts show properties to stop diarrhea and dysentery and to stop bleeding. Fruit peel extract is reported to have strong antiviral and antimicrobial effects and consumption of pomegranate juice is effective in the treatment of AIDS [68],[69]. In India, infusions of dried bark flowers have been used to treat diarrhea, intestinal worms, epistaxis and ulcers. It is noteworthy that the application of pomegranate peel powder can help in the healing of bleeding gums in patients with periodontics [3].

1.7 Pomegranate Seed

Pomegranate seed oil contains 80% punisic acid, phytoestrogens and estrone. Pomegranate is a fruit rich in phenolic compounds such as polyphenols, flavanoids, tocopherols, terpenoids, alkaloids, sterols, aromatic compounds, hydrolyzable tannins, fatty acids and amino acids, which account for 92% of its antioxidant activity. Among the polyphenols found in pomegranate; punicalagin, caffeic acid, ellagic acid and luteolin compounds, punicalagin has been reported to provide the most effective antiviral effect against influenza [87], [71]. Punicalic acid in pomegranate seeds is known to be effective against various chronic diseases in humans due to its therapeutic effects [43]. As evidenced by various *in vivo* experiments, pomegranate seeds contain conjugated linolenic acid (CLnA) (punisic acid) as the main compound that fights against inflammation and metabolic syndrome. Recently, studies have been conducted on the use of pomegranate fruit in the prevention and treatment of type-2 diabetes. The outer peels, flowers and seeds of pomegranate fruit are effective in type-2 diabetes by reducing oxidative stress and lipid peroxidation [9]. Studies to determine the health effects of pomegranate seed oil in particular have shown that pomegranate seeds, which are rich in conjugated linoleic acid, reduce the risk of colon cancer and atherosclerosis in experimental animals and have positive benefits on the immune system. It has been reported that consumption of 8 ounces (226.8 g) of pomegranate juice per day reduces the risk of high blood pressure, stroke and heart attack by 5% of systolic blood pressure [6]. Punisic and trienoic acids, which are highly present in the oil of pomegranate seeds, have anticarcinogenic properties even at very low doses, and in a study on lung cancer, it was determined that pomegranate extract given orally to mice caused a significant reduction in the growth of tumors in the lung [89]. Pomegranate seeds contain significant levels of fatty acids such as palmitic acid, stearic, linoleic, linolenic and oleic, and the peel contains tannin flavones such as luteolin, quercetin and gallic [42], [62], [60].

1.8 Pomegranate Flower

Pomegranate flower is a pomegranate product in which the flowers of the pomegranate fruit are collected and dried, then brewed as tea and consumed hot or cold. Pomegranate flower has been used in Ayurveda, Unani and Chinese medicine since ancient times for its therapeutic effects. With polyphenols, anthocyanins and organic acids in its structure, pomegranate flower has a strong antioxidant effect. [59] detected pelargonidin-3,5-di-O-glucoside anthocyanin in pomegranate flower. [29] reported that pelargonidin-3,5-di-O-glucoside and pelargonidin-3-O-glucoside anthocyanins were found in pomegranate flower and that these two types of anthocyanins have strong antioxidant activities. Pomegranate flower contains gallic acid as in fermented products of pomegranate [47], [48]. Apart from these, ellagic acid and oleanolic, ursolic, maslinic, acetic triterpene acids are other compounds showing anticancer and antioxidant effects [36]. [91] reported

that pomegranate flower extract was effective against free radicals and oxidative damage in DNA. [41], in a study investigating the antioxidant properties of pomegranate flower, revealed that pomegranate flower has a preventive effect on acute oxidative tissue damage in mice. In studies conducted in rats, pomegranate flower was shown to be effective against fatty liver, type-2 diabetes and obesity; and to significantly reduce LDL-cholesterol, triglyceride and blood glucose levels [88],[8]. Pomegranate flower tea is a pomegranate product that is not consumed much. Its protective and preventive effect against diseases is mostly due to the phenolic substances in its structure. It would be useful to increase studies on the nutritional value and antioxidant effects of pomegranate flower.

2 Conclusion

Pomegranate is a fruit grown in many countries of the world, especially in the Mediterranean climate, and its economic value has been increasing in recent years. This fruit has gained great importance in terms of nutrition not only because of its flavour, but also because it contains many antioxidant substances and phenolic compounds beneficial to human health. It has been known for many years that pomegranate and products derived from pomegranate are very beneficial for health and have been used in folk medicine from past to present. In addition; in recent years, many studies have been carried out and continue to be carried out on various components and activities of pomegranate. The positive effects on human health are noteworthy due to the antitumor effect of the antioxidant substances it contains. In studies using pomegranate juice, peel and seeds, anticancer activity has been detected. Based on this information, they stated that all pomegranate components (pomegranate juice, peel, leaves, flowers, roots, etc.) have phytochemical and pharmacological cancer preventive and therapeutic effects.

Our country is one of the world's leading producer countries. For this reason, our people have the chance to reach pomegranate fruit abundantly and cheaply. In order to turn this chance into a benefit, it is necessary to raise awareness of our people in order to make the habit of consuming pomegranate widespread in society. For this purpose, the Ministry of Agriculture and Forestry should publish informative public service announcements on the health benefits of pomegranate. Despite the production potential of our country, the consumption potential is quite low. Increasing the consumption of fresh fruit juice as a society will be possible by increasing the number of warehouses with controlled atmosphere. In addition, the correct and healthy processing and evaluation of the product depends on increasing the number of facilities required for this and improving the condition of existing facilities. Organizations in the food sector need to produce high value-added products from pomegranate. It is important for the country's economy to utilize these products in domestic and foreign markets with the right marketing policies

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