IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, January 2024

Punicagranatum (Pomegranate) with Anthelmintic Activity

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Abstract: *Ancient civilizations have long recognized the therapeutic and nutritional advantages of pomegranates, or Punicagranatum. Furthermore, pomegranates have been a part of many cultures' diets since prehistoric times (4000–3000 B.C.). According to one account, it was first cultivated in Iran; according to another, it was in India or Turkey. After that, trade channels were used to spread it throughout the world. This study focused on the pomegranate by reviewing the literature to learn about its history, categorization, and description; its medical and therapeutic value; the chemical makeup of the different pomegranate sections; and, lastly, its antiparasitic properties.Modes:2antibacterial, anti inflammatory, antiviral, and anticarcinogenic activities. The fruit also improves cardiovascular and oral health. These beneficial physiological effects may also have preventive applications in a variety of pathologies. The health benefits of pomegranate have been attributed to its wide range of phytochemicals, which are predominantly polyphenols, including primarily hydrolyzable ellagitannins, anthocyanins, and other polyphenols. The aim of this review was to present an overview of the functional, medical, and physiological properties of this fruits antiviral, antibacterial, anti-inflammatory, and anticarcinogenic properties. The fruit also enhances dental and cardiovascular health. These advantageous physiological effects might also be used to avoid various illnesses. Pomegranates contain a wide range of phytochemicals, mostly polyphenols (mostly hydrolyzable ellagitannins, anthocyanins, and other polyphenols), which are thought to be responsible for their health benefits. An overview of this fruit's physiological, medicinal, and functional characteristics was the goal of this review. Fresh and juiced, the pomegranate (Punicagranatum L.) is a popular ancient fruit. Pomegranate fruit has been used for medicinal purposes since ancient times, and stories about its benefits have persisted over time. Studies conducted in vivo and in vitro have shown that this fruit has antibacterial, anti-inflammatory, antiviral, and anticarcinogenic properties in addition to acting as an antioxidant, antidiabetic, and hypolipidemic.*

Keywords: Pomegranate; Chemical constituents, Medical significance; Anti-parasitic activity; Pomegranate extracts

I. INTRODUCTION

A shrub native to the Middle East and the Mediterranean, the pomegranate tree (Punicagranatum L.) is a member of the Lythraceae family and is commonly grown in warm-temperate climates worldwide. The popular pomegranate is the fruit of the edible variety. This species, of which there are over 500 cultivars worldwide, is characterized by a significant genetic variety of physical and biochemical properties [1].The dwarf pomegranate is a naturally occurring variation of the species, known by various names such as Punicagranatumvar.nana, Punicagranatum 'Nana,' P. granatum var. nana Pers., and Punica nana L. While it has occasionally been regarded as the third species of Punica [2], Currò et al.'s studies [3] on pomegranate microsatellite loci -shows that itGiven that P. granatum var. nana's fruit is currently only used for ornamental purposes, this article aims to perform a physicochemical characterization of the fruit in order to assess its potential for value addition. Specifically, it explores the fruit's potential as a feedstock for bioenergy and as a source of environmentally friendly agrochemicals. In this regard, the use of products based on natural compounds for integrated pest control is encouraged by EU laws (Council Regulation (EC)834/2007, Commission Regulation (EC) 889/2008, Article 14 of Directive 2009/128/EC, Regulation (EU) 2019/1009, etc.). Thus, the effectiveness of dwarf pomegranate whole-fruit extracts against three phytopathogenic bacteria that significantly reduce the yield of woody crops has been studied in this work: two microbes, specifically Erwinia Turkey. These days, it's widely consumed all around the world in a number of ways, such as juice, jam, and as a garnish for salads and other dishes [3]. From there, it probably traveled via old trade routes to other areas, such as China, India, and the Mediterranean countries. Pomegranates have been cultivated and consumed for a very long time in human history. They were used as a food source and a medicinal remedy by many ancient societies. For example, it was employed in Ayurvedic texts to treat a variety of ailments, including inflammation and diarrhea, in ancient medicine. Moreover, religious ceremonies and artwork from earlier eras incorporated the fruit's symbolism and associations with fertility and riches, particularly from the Persian and Egyptian civilizations [4]. Pomegranates have been named in approximately 500 variations (IPGRI, 2001; Stover and Mercure, 2007). This species has a high degree of genetic diversity (Verma et al., 2010). Over 90% of all commercial trees planted in the United States are Wonderful pomegranate trees, which is currently the industry standard cultivar (Chater and Garner, 2018).Nevertheless, "Wonderful" pomegranates are prone to fruit splitting, a significant production issue that can result in a notable loss of fruit (Chater and Garner, 2018).According to Holland et al. (2009), excessive or irregular irrigation, especially during fruit development, is thought to be the cause of fruit split.This may result in the arils expanding and splitting or cracking of the rind. In 2003, Prasad et al. discovered Consumers found Wonderful cultivated inland in Riverside, California, to be more palatable than Wonderful grown on the west coast in Ventura County, California. This was explained by the fact that pomegranates cultivated on the west coast had less sweetness and far higher acidity (Chater et al., 2018). These findings suggest that there is a great deal of opportunity to find greater pomegranate types in specific places than Wonderful. Thus, over the period of three years, from 2016 to 2018, the goal of this study was to assess the field performance of 22 pomegranate cultivars in west Texas based on phenology, yield, fruit phytochemicals, fruit sunburn, split, and rot.

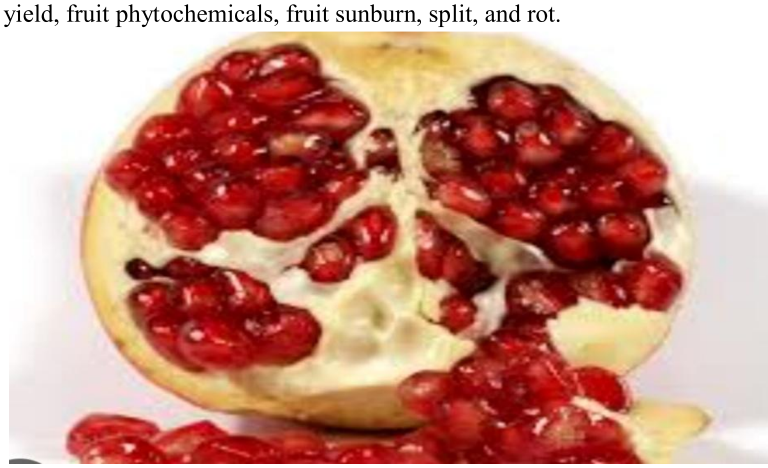

Fig 1:1 Pomegranate fruits

Classification and Morphology:

The pomegranate is a shrub with several stems that can reach a maximum length of 4.6 meters. Its leaves are 7.6 cm long, deciduous, and have a light green hue. The flowers are large, 5 cm long, glossy orange to crimson in color, and have a trumpet-shaped petal form. It is typically doubled because it is produced over a long summer's duration. Later, the fruit develops into an 8–12 cm–diameter spherical to lower sphere with a leathery covering that is glossy red to yellowish-green in color and loaded with crunchy seeds that are individually covered in a membrane [8, 9]. It also has a stiff tubular calyx. Additionally, pomegranate (P. granatum) is a tiny tree or deciduous shrub that bears fruit.

Table 1: Pomegranate classification system [13]

Kingdom_ Plantae: Subkingdom _Tracheobionta – Vascular plants

Magnoliophyta: Plants with flowers

Class-Dicotyledons in Magnoliopsida

Family Punicaceae- - Pomegranate family

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Chemical Constituents:

Surprisingly, every portion of the pomegranate has a wealth of vital nutritional and therapeutic components. Among other things, fruit peel, tree bark, and roots all contain alkaloids. Antioxidants like polyphenols are also abundant in pomegranate seeds and juice. The fruit also contains significant levels of potassium, vitamin K, and vitamin C—all of which are necessary for optimal health [14, 15]. The main component of pomegranate seeds, on the other hand, is hydroxybenzoic acid. lignins, conjugated and non-conjugated fatty acids, triterpenes, isoflavones, phenyl aliphatic glycosides, and tocopherols [16].Ellagic acid, ellagitannins (including punicalagins), punicic acid, and many piperidine alkaloids make up the majority of the medicinally useful components of pomegranate bark, but punicalin and punicalagin are also present

Environmental Elements:

Fruit cracking has been found to be influenced by environmental conditions, particularly temperature and humidity (Khub 2014), temperature differences between day and night (Abd&Rahma-, 2010), and sudden drops in temperature (Plame-ac, 1972). According to Frazier and Bowers (1947), weather factors such as air temperature, wind velocity, air relative humidity, canopy temperature, and fruit surface temperature have also been thought to be potential causes of cracking. The magnitude of cracking in immature fruits is strongly impacted by the relative water content and water potential of the leaf, which are indicators of water stress, as Sigh et al. (2014) unequivocally demonstrated. The fruit air temperature difference (FATD) and canopy air temperature difference (CATD) were two physiological measures that were impacted by high temperature stress. Leaf water was significantly linked with both CATD and FATD.

The importance of pomegranates in medicine

Given how many digestive system issues and skin conditions it has been used to treat, pomegranates are unquestionably among the oldest plants utilized for medicinal purposes since antiquity. It has also gained popularity as a "super food" in recent years due to its high antioxidant content, which is believed to help the body fight against a variety of illnesses. Its anti-oxidant qualities have been linked to a decreased risk of heart disease, cancer, and Alzheimer's disease. It has also been discovered that pomegranates have anti-inflammatory properties that may lessen the symptoms of inflammatory conditions like arthritis and others. The fruit's alleged health benefits have prompted the development of many pomegranate-based nutritionaParaphrase without limits.

Pomegranate Bioactive Compounds Bioavailability-

While the data supporting the usage of pomegranates is highly encouraging, more research is needed to fully grasp its potential health benefits before advocating regular use (Syed and others 2007). Little is known about the absorption, bioavailability, biodistribution, and metabolism of the key bioactive chemicals present in pomegranates and in other fruits, such as phenolic acids, flavono---ids, and tannins, although they undoubtedly share common routes (Petti and Scully 2009). While esters, glycosides, or polymers need to be hydrolyzed before being absorbed, aglycones, or the nonconjugated forms, are typically absorbed intact from the digestive tract (Petti and Scully 2009). An investigation into the in vitro digestion of pomegranate juice revealed the availability of pomegranate phenolic chemicals

II. MATERIAL AND METHOD

propagation of plant material. Hardwood trimmings22 different pomegranate varieties (15 cm) (Table 1) were taken from amarcelino's nursery, a commercial nurseryTexas'sTornillo) in 2014. The portions that were cuwere propagated using RL98 Ray in a greenhouse. Cone-tainers for leaching (Stuewe and Sons, Tangent, OR). Cuttings with roots were moved.up to 5-L treepots (height, 30.5; width, 12.7 cm) Stuewe and Sons; CP512CH, cm) packed withMetro-Mix 902, a commercial substrate (SunGro, Agawam, MA). Every plant was developed. ingreenhouse with natural gas heating systems and pad-and-fan cooling to regulate the temperature. Plants were Watered with a nutritional solution at 1.2 dS·m–1 electrical conductivity (EC),was made by incorporating 15N-2.2P-12.5K.(Cal-Mag Special, Peters 15–5–15; Scotts, Marysville, OH) for osmosis reverseplant material propagation. Hardwood trimmings Twenty-two distinct pomegranate types (15 cm) were selected (Table 1) from a A commercial nursery called Marcelino's Nursery Tornillo, Texas) in 2014. The sections that were removed were propagated in a greenhouse using RL98 Ray. Leaching

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containment cones (Stuewe and Sons, Tangent, OR). Root-bearing cuttings were relocated. treepots up to 5-L (30.5 cm in height and 12.7 cm in width)packaged with Stuewe and Sons; CP512CH, c SunGro, Agawam, MA sells Metro-Mix 902, a co-mmercial substrate. Every plant has grown. in a greenhouse equipped with pad-and-fan cooling systems and natural gas heating systems for temperature control. Plants were1.2 dS·m–1 electrical conductivity (EC) nutritional solution was used to irrigate the plants. was created by adding 15N-2.2P-12.5K.(Peters 15–5–15, Cal-Mag Special; Scotts, Marysville, OH) for everseosmosis Every year in October, all the fruits were picked, with the exception of the first year, in which no fruits were collected. Fruits were gathered in accordance with the block sequence. Fruit count, fruit fresh weight (FW), yield, fruit soluble sugar content (Brix), and fruit resistance to split, sunburn, and black rot were the data that were gathered. Each fruit was examined separately for signs of split, sunburn, and black rot; the incidences were noted as the percentage of fruit exhibiting symptoms. The resistance was computed by deducting the incidence percentage from 100.Fruit FW was measured in grams, and yield per tree was measured in kilos. Three representative fruits from each block and variety were chosen for arils collection, and a manual garlic press was used to measure the juice extracted.

In October 2010, pomegranate leaves, peels, seeds, and flowers were collected from pomegranate trees in the province of "Gabès" (Southern Tunisia: 33°40„N, 10°15„E). Samples were taken from several commercial "Gabsi" variety trees. Samples were gathered, dried in the sun, and then powdered. Ten grams of powdered leaves, peels, seeds, and flowers were macerated for one night at 30°C in 100 milliliters of methanolic extracts. The same quantity (10 g) was extracted separately and agitated for a night at 30°C with 100 ml of water. To stop the solvent from evaporating, the solution was placed under parafilm in each instance and stirred continuously for a full night. Extractions of phenolic compounds from various tissues were carried out in a uniform environment. Whatman No. 1 filter paper was used to filter the extracts for

Chemicals

Without any additional purification, all of the solvents were of the reagent grade. From Sigma Chemical Co. (St. Louis, MO, USA), gallic acid, cyanidin-3-glucoside, tannic acid, and Folin-Ciocalteu's phenol reagent were acquired. We bought rutin and trolox from Aldrich in Milwaukee, Wisconsin. We purchased the methanol of analytical reagent grade from Lab-Scan (Labscan Ltd, Dublin, Ireland). Millipore S.A.S., Molsheim, France, provided the Millipore Simplicity water Elfalleh et al. 4725 used for sampling. Sigma Chemical Co. (Poole, Dorset) supplied all of the chromatography-grade chemicals employed in the antioxidant activities. On a Shimadzu ultraviolet (UV)-1600 spectrometer (Shimadzu, Kyoto, Japan), spectrophotometric measurements were carried out.

Screening for phytochemicals in a qualitative manner-

Using the relevant reagents and chemicals, each extract was screened for the presence of important families of phytochemicals using the methodology presented by Marzouk et al. (2009) and previously published by Trease and Evans (1984) and Sakar and Tanker (1991).

Alkaloids were examined using Meyer's (KI/$MgCl_2$) and Bouchardat's (I_2/MgI_2) verified by Dragendorff's reagent. Flavonoids were examined using metallic magnesium and hydrochloric acid (HCl) in accordance with the Wilstater test. We examined the saponins' capacity to create suds. Tannins wereexaminedusing ferric chloride; the Bath-Smith reaction and strong hydrochloric acid corroborated the results.Total polyphenol content (TPP) was calculated using the Folin-Ciocalteu method, which was published in Elfalleh et al. (2009). 0.5 ml of methanolic solution and 0.5 ml of Folin-Ciocalteu (Prolabo) reagent were added from each sample. We add 4 milliliters of a sodium carbonate (1 M) solution. The tubes were placed in a 45°C water bath for five minutes before being placed in a cold water bath. A Shimadzu 1600-UV spectrophotometer was used to measure the absorbance at 765 nm. Each fraction's TPP was translated into milligrams of gallic acid equivalents per gram of dry weight (mg GAE/g DW).For the purpose of sampling, Elfalleh et al. 4725 was produced using a Millipore Simplicity (Millipore S.A.S., Molsheim, France). Sigma Chemical Co. (Poole, Dorset) supplied all of the chromatography-grade chemicals employed in the antioxidant activities. On a Shimadzu ultraviolet (UV)-1600 spectrometer (Shimadzu, Kyoto, Japan), spectrophotometric measurements were carried out.Screening for phytochemicals in a qualitative mannerUsing the relevant reagents and chemicals, each extract was screened for the presence of important families of phytochemicals using the methodology

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Anti-Parasitic Activities

For an extended period, parasitic illnesses have posed a severe worldwide threat, especially in densely populated nations and civilizations with inadequate resources. Additionally, as time goes on, parasite resistance to drugs generally increases, exacerbating the problem and decreasing the efficacy of the therapies. It increased the global economic burden as a result, and it is undeniable that these factors made the development of novel medications derived from medicinal plants essential. Furthermore, because so many of its parts—roots, bark, stem, and peels—have been used as vermifugal and taenicide agents, the pomegranate is seen to be one of the most important of these plants to research and employ [41, 42]. Since ancient times, pomegranates have been utilized as an antiparasitic; the Egyptians were among the first to do so.

Eimeri

parasites called apicomplexan that infiltrate the intestines and cause coccidiosis, a dangerous intestinal illness with repercussions for the world economy. With symptoms ranging from severe hemorrhagic enteritis to asymptomatic sickness, the illness has notable rates of morbidity and mortality. However, the type of Eimeria determines whether intestinal lesions arise. The most important species include Eimeriatenella, Eimerianecatrix, Eimeriaacervulina, Eimeria maxima, Eimeriabrunetti, Eimeriamitis, and Eimeria praecox. The coccidiosis that these Eimeria species cause in hens poses a major danger to the global poultry industry. Disease prevention and control can be aided by appropriate management techniques and timely treatment [88].5.9.1Pomegranate activities in opposition to EimeriaKhorrami and associates examined how pomegranate peel extract affected Eimeria in order to evaluate

Anti- Anthelmintic activity of Pomegranate against Asuum

-Pomegranate's anti-anthelmintic properties against A. suumIthas been demonstrated that some pomegranate plant parts, such as the fruit hulls and roots, contain antihelmintic properties. It has been determined that a number of noteworthy alkaloids, most notably pelletierrines, possess anthelmintic action. As a vermifugal or tanicidal agent—that is, a poison that kills and expels intestinal worms—it has been used most frequently. These alkaloids have been used for a long time to treat parasite diseases, and new studies have demonstrated promising outcomes when using them to treat drug-resistant parasite strains [42, 80]. Although this plant has been used for a long time in traditional medicine, its antihelminthic properties have just recently been well studied. Researchers found that it contained bioactive substances with potent antiparasitic effects, including as tannins and alkaloids. To be precise,

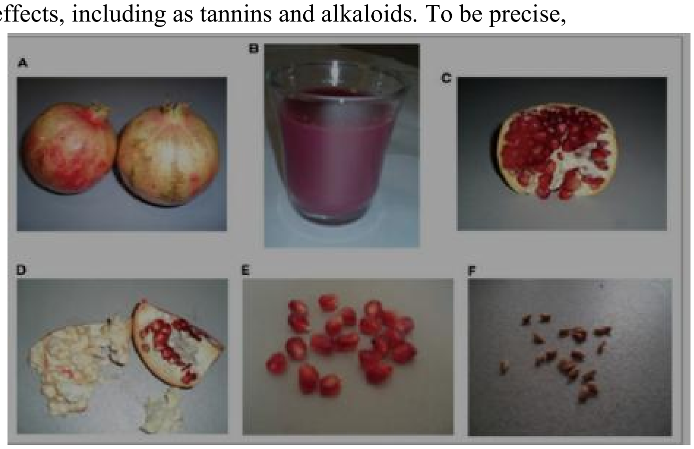

Figure 2 : The pomegranate fruit's various components (A) Pomegranate juice (B) peel (D) pomegranate arils (E) and pomegranate seeds (F)

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Phenolic substances

Phenolic compounds in all their forms are one of the primary substances that give many foods, including pomegranate fruit, their useful qualities (Viuda-Martos and others 2010a). Flavonoids are the most prevalent and broadly dispersed subgroup of natural polyphenols, with phenolic acids, phenylpropanoids, and flavonoids being simple molecules, and lignins, melanins, and tannins being highly polymerized compounds (Soobrattee et al., 2005). Chemically speaking, compounds with an aromatic ring attached to 6 are known as phenolic acids

Additional parasites

-Because pomegranate has anti-parasitic properties against more than just the parasites listed above, studies on the fruit have been expanded to include a wide range of parasites that affect both humans and animals. For example, El-Sherbini and associates looked into pomegranate's antiparasitic properties against Trichomonasvaginalis. When patients with T. vaginalis infections were given pomegranate juice in both in vitro and clinical testing, the symptoms disappeared after two months. Pomegranate juice significantly affected T. vaginalis development in the in vitro investigation, which was consistent with the findings of the clinical trial [93]. Furthermore, pomegranate alkaloids found in the fruit rind, tree bark, and roots assist the "tapeworm" release its hold on the gut wall, making it easier for the weaker parasites to be expelled

Practical attributes

The scientific community is currently quite interested in the functional qualities of pomegranates. Currently, 770 scientific publications are cited in the Science Direct (2010) database about the beneficial qualities (antioxidant, antibacterial, or to prevent diabetes, cancer, and vascular illnesses) of pomegranates and their derivatives, including juice, seed oil, peel, and so forth. Stronger scientific evidence is need to validate these impacts, though.

Because of the beneficial chemicals found in various fruit portions that have both functional and therapeutic properties, pomegranate fruit may qualify as a functional food (Figure 4). According to Davidson and others (2009), they can function as antitumoral (Hamad and Al-Momene 2009), antihepatotoxic (Celik and others 2009), antioxidant, or as agents that promote cardiovascular health.

Antidiabetic Characteristics

The most prevalent metabolic illness worldwide is diabetes, and its prevalence is rising. 194 million individuals worldwide had diabetes in 2003; by 2025, that number is expected to rise to 333 million, according to the International Diabetes Federation (Sicree and others 2003). After cancer and cardiovascular diseases, it is the third most common disease, according to the World Health Organization. Pomegranate fruits and their derivatives can be useful in the diet as one strategy for managing diabetes mellitus. Numerous investigations (Huang and others, 2005; Li and others, 2005; Katz and others, 2007; Parmar and Kar, 2007; Li and others, 2008; Bagri and others, 2009) have in factreported their antidiabetic efficacy.

Principal functional and medicinal effects of pomegranate

Heart-related Conditions

Dyslipidemia, which is primarily defined by increased levels of low-density lipoprotein cholesterol (LDLC) and/or decreased high-density lipoprotein cholesterol (HDL-C), is one of the key risk factors for the development of coronary heart disease (Esmaillzadeh and Azadbakht 2008). Low-density lipoprotein (LDL) oxidation is hypothesized to play a role in atherosclerosis and cardiovascular disease (Heinecke 2006). Because oxidized LDL is more easily absorbed by macrophages via scavenger receptors, it is believed that oxidation of LDL lipids makes the lipoprotein atherogenic (Heinecke 1998).

High blood levels of LDL-C and total cholesterol are independent risk factors for cardiovascular disease and may cause atherosclerosis, according to epidemiological research (Russo et al., 2008). Numerous inflammatory and oxidative changes within the arteries are associated with atherosclerosis, a major degenerative disease of the arteries.

III. CONCLUSION

We collected all of the published research on Pg without date elimination for this review. Still, every effort was made to provide an explanation for the new data. Pg is thought to have originated primarily in Iran. Pg juice, fruit, and extracts have long been employed for a variety of medicinal purposes in ancient civilizations' folk medicine.;[18]

ACKNOWLEDGEMENT

The author would like to express sincere gratitude to the management of Late Bhagirathi Yashwantrao Pathrikar College of Pharmacy for their continuous support and encouragement in this work

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