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A SYSTEMATIC REVIEW ON MEDICINAL PLANT: POMEGRANATE

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ABSTRACT

Pomegranate (Punica granatum L.), one of the oldest given fruits, is presently considerably consumed throughout the world. Its fruits and seeds as well as other anatomical chambers (e.g., flowers and leaves) are rich in numerous bioactive mixes and therefore, the scientific interest in this plant has been constantly growing in recent times. It has been shown that pomegranate and its extracts parade potent antioxidative, antimicrobial, and anticarcinogenic parcels. The present review summarizes some recent studies on pomegranate, pressing mainly its vasculoprotective part attributed to the presence of hydrolyzable tannins ellagitannins and ellagic acid, as well as other mixes (e.g., anthocyanins and flavonoids). These in vitro and in vivo studies showed that substances derived from pomegranate reduce oxidative stress and platelet aggregation, reduce lipid uptake by macrophages, positively influence endothelial cell function, and are involved in blood pressure regulation. Altogether, the reviewed studies point out the implicit benefits of a broader use of pomegranate and its constituents as salutary supplements or as adjuvants in remedy of vascular conditions, analogous as hypertension, coronary thruway complaint, and supplemental thruway complain.

INTRODUCTION

Linnaeus described the rubric Punica for the first time in 1753. It's traditionally treated under the Punicaceae, a monogeneric family of two species i.e., Punica granatum and Punica protopunica. The species P. protopunica, so called Socotra pomegranate, is endemic to the island of Socotra, Democratic Republic of Yemen(Guarino et al. 1990).[1] Pomegranate (Punica granatum L.) has been used in various regions and folk or traditional medical

systems as a food supplement or a medicine because of its enormous mixes with lots of exertion and without bane. In addition to eatable use, nearly all corridor of this plant are used pharmaceutically worldwide, for illustration, the pericarp is used by Chinese for the treatment of diarrhea, metrorrhagia, metrostaxis and bellyache; the flower is used as a food supplement to treat diabetes mellitus in Unani medicine; the bark and root are believed to have anthelmintic and vermifugic parcels in Ayurvedic medicine; the fruit is employed by South Africa people for the treatment of diarrhea.[2]

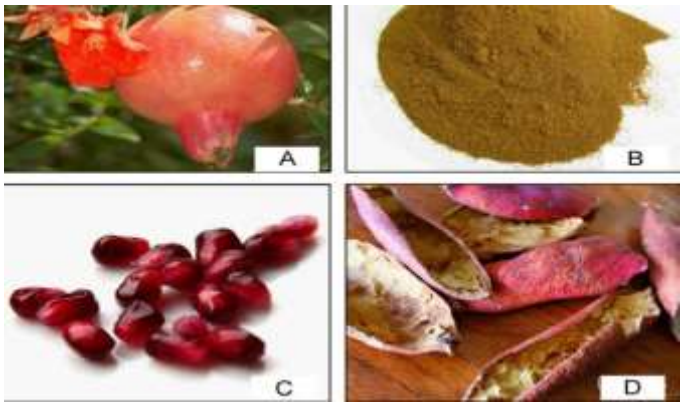

Fig. 1: [A] Pomegranate fruit and anatomical components, [B] pomegranate peel powder, [C] pomegranate seeds and [D] sundried pomegranate peel[3]

Botonical description

Table 1: Botonical classification of pomegranate.

Kingdom	**Plantae**
Division	Megnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Family	Lythraceae
Genus	Punica
Species	P. granatum
Chromosome number	2n = 18

Phytochemical constituents of different parts of pomegranate plant

Seeds: Seeds represent an indigestible bit of pomegranate, correspond to 11 w/ w of the fruit and contain the largest pomegranate lipidic bit; they're substantially used to prize the pomegranate seeds oil painting oil oil painting (PSO).[4,5,6] PSO is rich in adipose acids, which are substantially poly- unsaturated (PUFA, up to 91.53), followed by mono-unsaturated adipose acids (MUFA, over to 7.55) and impregnated adipose acids SFA, over to 6.82). Punicic acid is the most abundant adipose acid (ranging between and 86.41),

followed by linoleic acid (4.11 – 11.32). Of note, punicic acid is a conjugated- linoleic acid that showed benefits against skin cancer as well asanti - rotundity and antioxidant goods.[7] Oleic acid is the main MUFA (ranging between 3.63 and 7.12), followed by palmitic acid (2.53 – 5.15) and stearic acid (1.33 – 1.92). In addition to adipose acids, PSO also counts sterols (in the range of 7.5 and 16.4 mg/ g of oil painting oil oil painting), playing a critical part in the regulation of LDL cholesterol situations (Khemakhem et al.,). The main sterols set up in PSO are- sitosterol, D - 5 avenasterol, campesterol, stigmasterol and sitosterol. Seeds also contain triterpenes (0.99 – 3.13 mg/ g of oil painting oil oil painting), similar as cycloartenol and betulinol, and tocopherols (678.3 – 2627.4 g/ g of oil painting oil oil painting), for case, - and – tocopherols. Regarding phenolic composites, seeds are a source of anthocyanins, similar as delphinidin, cyanidin and pelargonidin, and tannins, but less abundant compared to other corridor of pomegranate.[8] Li et al. studied PSO composition throughultra-high- performance liquid chromatography coupled with quadrupole- Orbitrap high- resolution mass spectrometry; their results revealed that the major flavonoids were genistein, kaempferol, rutin, gallocatechin, luteolin, scutellarein and apigenin.[9] The total flavonoid content ranged between 2.5 and 7.5 mg rutin original per g of excerpt. Seeds also contain proanthocyanidins, responsible for their pungent and chelating substance ion exertion, coumarins, filaments and hydroxybenzoic acids. Although multitudinous studies on seed oil painting oil oil painting amino acids content have been published, PSO seems to contain significant quantum of glutamate, arginine, aspartate, phenylalanine and leucine.

Leaves: Pomegranate has lustrous and narrowoblong leaves that are used to produce extracts or, in folk medicine, for infusion, tea or spices.[10] Of note, 23 mixes (11 phenolic acids, 8 tannins, 3 anthocyanins and 1 flavonoid) were linked by chromatographic fashion, and the major conflation reacted EA (43.14 0.57 g/ mg of the bit).[11] Leaves are also a source of alkaloids and minerals in different chance according to the age of the plant.

Fruit: Arils are the eatable part of pomegranate, made of a red pulp[12] and seeds they're used to squeeze the PJ and are endowed with a sweet – sour taste. Arils are composed of 85 water, 10 sugars and 5 of other bioactive mixes. numerous studies, using different pomegranate kinds, indicate that glucose and fructose are the main sugars present in arils also, arils contain hydrolyzed tannins and, in particular, ellagitannins, analogous as punicalagins, punicalin, gallic acid, corilagin and, polyphenols, analogous as flavonoids

(catechin, epicatechin, quercetin, rutin, epigallocatechin), Anthocyanin content shifts from 9 to 115 mg/ L juice, including mixes like delphinidin, cyanidin and pelargonidin. Arils are rich indeed in organic acids, analogous as citric acid, malic acid, succinic acid and oxalic acid, that are responsible for the acid – sour taste, as well as in vitamin C, a important antioxidant, in a volume similar to Citrus fruits. ultimately, arils are a source of minerals, for illustration, magnesium, boron, selenium, zinc, cobalt, calcium and sodium in different amounts depending on cultivars and kinds. An innovative product is fermented juice, attained through fermentation with different kinds of provocations and characteri zed by an enrichment of bioactive mixes, in particular of free polyphenols, due to the capability of the fermentation process to break flavonoid – sugar liaison. Kim et al. described a process characterized by a fermentation with wine incitement (Saccharomyces bayanus, Prise de Mousse) for 2 months. After alcohol remotion, the liquor was concentrated and added with ethyl acetate, and also, it was dried in a vacuum evaporator to gain the residue.[13] On the other hand, Akter et al. described the product of a fermented juice using Lactobacillus vespulae DCY75 incitement and tannin acyl hydrolase.

Flower: P. granatum flowers are characterized by round pink petals about 3 cm in fringe and bloom in summertime. The flowers are anon-comestible bit, but their extract, by infusion or decoction, is traditionally used for the treatment of inflammation, diabetes, bacterial infection (including Salmonella enterica) and bronchitis. From a phytochemical point of view, P. granatum flowers are rich in flavonoids 29.5 0.8 mg quercetin fellow/g dry weight), tannins (30.6 0.6 mg catechin fellow/ g dry weight) and phenolic acids, analogous as gallic acid or EA (330.9 11.3 mg gallic acid fellow/ g dry weight).[14]

Anatomy of pomegranate plant

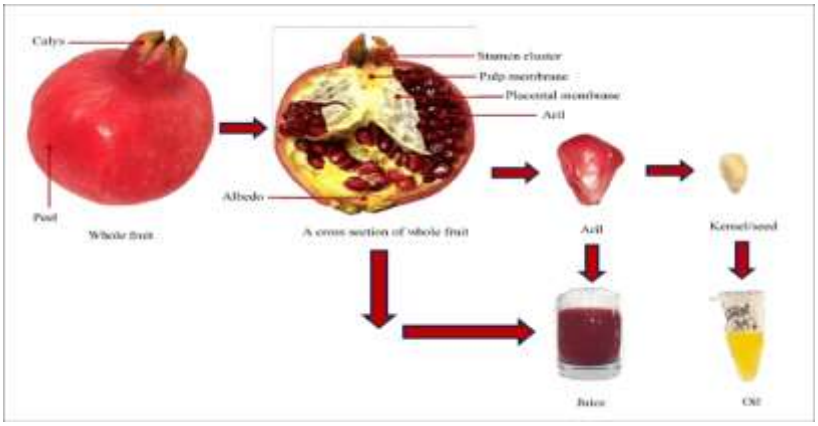

Fig. 2: Anatomy of Pomegramate.

Medicinal Uses of the pomegranate: Pomegranate has reportedly been used medicinally by the peoples of multitudinous societies for centuries to treat conditions analogous as diabetes and to combat malarial freeloaders still, it's just within the formerly decade that scientific disquisition related to the health goods of pomegranate has increased substantially. Because of the high in vitro antioxidant exertion of pomegranate products, a wide variety of conditions and health conditions that appear to have some relationship to the body's capability to shield off oxidative stresses have been excavated of note, multitudinous pomegranate products are being vended for specific health goods, despite limited scientific data. Mortal clinical trials are fairly numerous in number but have shown positive goods of pomegranate juice consumption on prostate cancer prevention and cardiovascular health. Salutary goods of pomegranate products have also been observed in beast models for prostate, colon, bone, and skin cancers, as well as for hyperlipidemia, atherosclerosis, and diabetes prevention and treatment. Although the weight of validation is not sufficient for any one health claim, there's some primary validation that shows pledge.

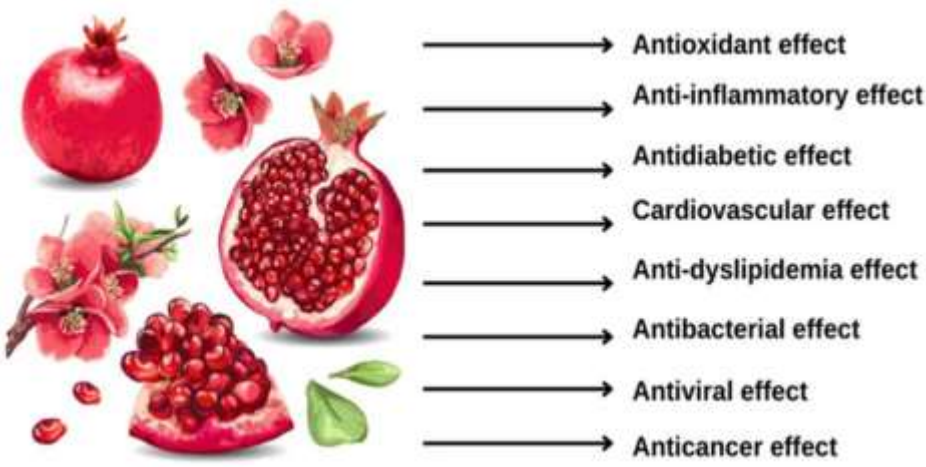

Fig. 3: Effects shown by pomegranate fruit.

Cancer Effect: Inhibition of cancer by pomegranate products has been studied for prostate, bone, colon, skin, lung, and cervical cancers, as well as leukemia. Of these, prostate cancer has been the most well studied, and positive goods of pomegranate juice consumption have been demonstrated in humans. lower is known at this time about the salutary goods of pomegranate toward other cancers.

Prostate: In a study of 46 men with rising prostate-specific antigen (PSA) situations following treatment for prostate cancer, consumption of 8 oz per day of pomegranate juice significantly delayed the rise in PSA, adding the PSA doubling time from 15 months to

54 months predicated on birth versuspost- treatment measurements. Plasma analysis ahead and after treatment with pomegranate juice showed the treated subjects' tube to have advanced antioxidant and antiproliferative exertion.[15] At the time of publication, these authors indicated that a placebo- controlled trial to study these goods in farther detail was underway. Likewise, several studies in cell culture and beast models have reported inhibition of prostate cancer by pomegranate juice and extracts. In vitro, pomegranate ellagitannins and their urolithin metabolites were shown to inhibit CYP1B1, a cytochrome P450 (CYP450) enzyme associated with prostate cancer induction and progression. However, only urolithins A and B at advanced attention inhibited this enzyme in pros tate cancer cell societies.[16] likewise, urolithin A glucuronide, urolithin B glucuronide, and dimethyl ellagic acid were the only ellagitannin metabolites detected in mortal prostate apkins after three days of pomegranate juice or walnut consumption former to dieting for surgery.

Colon: Prevention of colon cancer with pomegranate products is mainly theoretical, with only a numerous studies in beast models and cell societies for support. The number of azoxymethane- induced aberrant vault foci in rats, an beast model for colon cancer, was significantly dropped by consumption of pomegranate juice and punicic acid – rich pomegranate seed oil painting oil.[17] also, in mortal colon cell societies, pomegranate juice inhibited proliferation and convinced apoptosis, possibly via an inflammatory c ell signaling medium. Punicalagin, the primary ellagitannin in pomegranate was shown to release ellagic acid in cell culture media, which laboriously induced apoptosis of colon cancer. It has also been shown that specific ellagitannins from pomegranate and the corresponding urolithin metabolites inhibited proliferation and convinced apoptosis of HT- 29 mortal colon cancer cells.

Cardiovascular Effect: Disquisition on goods of pomegranate products on cardiovascular health has been primarily concentrated on the prevention of atherosclerosis and the management of hyperlipidemia in diabetic individualities. Several mortal studies have been conducted, ultimate of which have shown benefits of pomegranate products on cardiovascular health in relation to blood pressure, cholesterol, intima media viscosity, and endothelial function. Elderly, hypertensive subjects (n = 10) that consumed pomegranate juice containing 1.5 mmol total phenols per day for two weeks endured a 36 drop in serum angiotensin II converting enzym e exertion and a 5 drop in systolic blood pressure, both of which are markers for cardiovascular complaint trouble.[18] After consumption of 50 ml pomegranate

juice per day for two weeks, tube from 13 healthy nonsmoking immature men had advanced antioxidant exertion, dropped lipid peroxides, increased arylesterase exertion, and increased resistance to bull sulfate – convinced high- density lipoprotein (HDL) oxidation. In this same report, it was demonstrated that pomegranate juice consumption dropped the number of head cells and the size of atherosclerotic lesions by 44 in apolipoprotein E – deficient mice, an beast model for atherosclerosis. In other mortal studies, atherosclerotic cases with carotid thruway stenosis (a narrowing of the roadways in the neck that supply blood to the brain) that consumed pomegranate juice (50 ml day −1) in addition to their regular medicine for one time (n = 10) had on average a 30 drop in intimamedia viscosity (IMT) compared with a 9 increase in IMTin control cases n = 9).[19] In a larger clinical trial (n = 289) conducted over an 18 - month period, healthy individualities with moderate trouble factors for coronary heart complaint (CHD) were instructed to consume either a pomegranate juice or placebo drink daily. The authors concluded from these data that individualities at advanced trouble for CHD served from pomegranate juice consumption. Additionally, a placebo- controlled mortal clinical trial using cases with ischemic CHD set up that quotidian consumption of 240 ml pomegranate juice for three months significantly dropped stress - induced myocardial ischemia (P< 0.05), whereas it increased in the placebo group Endothelial function was significantly bettered in adolescents with metabolic pattern (n = 30) after four weeks of supplementation with 240 ml per day of pomegranate juice or grape juice. Overall, it appears that pomegranate juice supplementation may contribute significantly to prevention of cardiovascular conditions, which is harmonious with current salutary guidelines that encourage consumption of at least five servings per day of fruits and vegetables. In a mortal clinical trial with hyperlipidaemic individualities (n = 45), consumption of 400 mg pomegranate seed oil painting oil twice daily for four weeks increased HDL cholesterol and dropped the total cholesterol HDL cholesterol rate as compared with a placebo.[20] These results indicate that there may be some long- term benefits of pomegranate seed oil painting oil consumption on tube lipid lives that are associated with cardiovascular health. The anti-atherosclerotic exertion of pomegranate juice was associated with increased serum paraoxonase exertion, dropped macrophage lipid peroxides, and dropped uptake of oxidized lowdensity lipoprotein (LDL) in macrophage cells.[21] A cure-dependent drop in cellular oxidative stress and dropped uptake of oxidized LDL in macrophage cells treated with pomegranate juice has been demonstrated in vitro, and it has been proposed that the dropped cellular oxidative stress observed with pomegranate juice treatment may be at least partly attributed to upregulation of paraoxonase 2 expression. likewise, a drop in oxidation-sensitive

gene expression and an increase in nitric oxide synthase exertion were set up in response to pomegranate juice supplementation in both hyper cholesterolemic mice and mortal coronary thruway endothelial cells exposed to high shear stress. Pomegranate juice was also shown to increase the bioactivity of nitric oxide synthase in mortal coronary endothelial cells by inhibiting the oxidation of LDL (oxidized LDL inhibits nitric oxide synthase) and upregulating the expression of endothelial nitric oxide synthase. Therefore, it appears that oxidized cholesterol can contribute to the conformation of atherosclerotic lesion (blocking of blood vessels) and also beget vasoconstriction due to a drop in the vasodilating conflation nitric oxide. These beast studies suggest that pomegranate supplementation could depress these goods by reducing the uptake of oxidized LDL in macrophages, and maintaining or adding nitric oxide situations in endothelial cells, thus preventing both atherosclerosis progression and vasoconstriction in partly blocked vessels. Extracts of pomegranate flowers, peels, arils, and pomegranate juice each dropped atherosclerotic lesions and lipid peroxides in mouse models and cell culture systems, but the seed extracts had no effect.[22] also, an extract prepared from pomegranate juice product by- product (the remaining portion of the whole fruit after juicing) reduced atherosclerotic lesion size by over to 57 and dropped markers of oxidative stress in a mouse model. Despite questions remaining on the bioavailability and metabolism of pomegranate ellagitannins, an unidentified hydrolyzable tannin isolated from pomegranate juice was also shown to significantly reduce atherosclerotic lesion size, drop tube lipid peroxidation, and inhibit macrophage uptake of oxidized LDL in apolipoprotein E - decificient mice predicated on mortal clinical trials and on beast data, the consumption of pomegranate juice and extracts appear to have pledge for maintaining or perfecting cardiovascular health.

Diabetes: Pomegranate flower extract and pomegranate authorities and concentrates have been studied for their places in operation of diabetes in both beast models (Zucker diabetic rats) and humans. Pomegranate flower extract consumed by Zucker diabetic rats, a type II diabetes model, dropped the anticipated glucose weight – convinced increase in tube glucose situations but had no effect on Zucker spare rats.[23] In addition to glucose metabolism in diabetic countries, pomegranate flower extract has also been shown to drop triglycerides and total cholesterol, drop cardiac fibrosis, and reduce adipose liver via up regulation of adipose acid oxidation in Zucker diabetic rat model systems. Pomegranate flower extract was also shown to increase HDL cholesterol, glutathione, and antioxidant enzymes in streptozotocin-induced diabetic Wistar rats and drop fasting blood glucose, TG, LDL cholesterol, VLDL

cholesterol, and kerchief lipid peroxidation. This is in agreement with the former beast studies and provides fresh information on the improvement in oxidative state upon treatment with pomegranate flower extract, a traditional anti diabetic medicine. Also, pomegranate juice extract consumed for four weeks was suitable to meliorate the biochemical and physiological goods of diabetes and hypertension induced in Wistar rats.[24] Hyperlipidemia and oxidative stress in diabetic cases puts them at increased trouble for heart complaint. Three mortal clinical trials have been conducted with diabetic cases to study the effect of pomegranate juice consumption on tube lipid and oxidation lives. Oxidative stress was dropped by 35 upon consumption of 50 ml per day of pomegranate juice for four weeks and was attributed to increased serum HDL- associated PON1 stability and exertion. After eight weeks of pomegranate juice concentrate (40 g) consumption by 22 diabetic cases, tube lipid lives were bettered, as substantiated by dropped total cholesterol, LDL cholesterol, and LDL/ HD L rate. Pomegranate juice consumption (50 ml day −1) for three months by diabetic cases and their healthy subject controls dropped serum lipid peroxides by 23, an indicator of an overall increased antioxidant exertion in vivo. There were also no negative consequences of pomegranate juice consumption in terms of blood glucose parameters. These clinical results involved only a numerous cases, but were supported by the beast model work that had been done in this area.[25]

Skin Care: Skin care products containing pomegranate extracts and seed oil painting oil are increasingly available and pledge rejuvenation, youthfulness, and beauty. still, disquisition on the capability of pomegranate to act as an effective cosmeceutical element is in the early stages of development. In mortal cell societies, pomegranate seed oil painting oil extract increased the number of keratinocytes performing in an increase in viscosity of the epidermis and pomegranate peel extract had no effect on keratinocytes, but increased the number of fibroblasts in a cure- response fashion, indicating stimulation of dermal form mechanisms.[26] Whole fruit extracts of pomegranate used to pretreat keratinocyte cells former to UVA or UVB radiation blocked the oxidative stresses generally observed under those conditions that are generally associated with aging. Oral supplementation with pomegranate extract handed protection against UV induced achromatism in mortal subjects that were prone to sunburn.[27] Pomegranate peel extract has also been studied in a guinea glutton model for skin whitening and set up to be effective. Only one study of a pomegranate cosmeceutical product was estimated in mortal subjects. The cream was a blend of pomegranate, green and white teas, and mangosteen, so the effect can't be distinctly associated with pomegranate from these data.

To date, there are limited scientific data to support the cosmeceutical claims for pomegranate. Still, the cell culture work in this area supports a implicit protective effect of pomegranate extract on skin cell form, furnishing a base for exploration in mortal clinical trials.

Microbial Application: Antiviral, antifungal, and antibacterial parcels of pomegranate products have been studied to some extent in vitro, but to a truly limited degree in beast models or mortal clinical trials. In netting of fruit authorities for inhibition of infection by HIV- 1 IIIB, pomegranate juice, indeed from different growing regions, was constantly the most inhibitory. These researchers further isolated the active antiviral element (s) by binding them to sludge brio and tested for retention of HIV specific antiviral exertion through development of an implicit topical microbicide. Authors proposed that this poisonous could be applied vaginally former to intercourse to help the list of HIV viral patches to their cell receptors, thus preventing infection.[28] Studies to test its effectiveness in mortal populations where control of HIV is delicate may be warranted. Pomegranate extract was shown to inhibit the influenza contagion by blocking its replication, inhibiting cohesion of red blood cells, and enjoying virucidal exertion. Further study of individual polyphenols present in the pomegranate extract showed that punicalagin was responsible for the antiviral exertion. A clinical trial to study this effect in humans is presently underway. Given our current knowledge of the intestinal metabolism of punicalagin in brutes, it will be of important interest whether the antiviral parcels of pomegranate extract can be effectively delivered in humans. Mortal clinical trials that excavated the use of pomegranate extracts for topical antibacterial and antifungal treatments in dental hygiene operations suggest some salutary goods. Twenty one of thirty cases with denture stomatitis responded to treatment with pomegranate gel extract compared with 27 of 30 cases that entered the standard micronazole treatment. Although the pomegranate treatment had a lower success rate than the micronazole, a significant proportion of cases responded to this treatment, indicating that there is implicit for development of this into a more effective product. Pomegranate extract was also set up to be an effective antiplaque marshland, similar in effectiveness to chlorhexidene, and was suggested for use as a thrice- diurnal marshland for reduction of gingivitis trouble.[29]

CONCLUSION

Pomegranate is a food that can be salutary to the mortal body because multitudinous studies have demonstrated its implicit salutary goods. The PJ and pomegranate extracts have a long

history of safety, and various pomegranate constituents have been developed as botanical salutary supplements to give a volition and easy form for consumption. Different studies have demonstrated the safety of pomegranate salutary supplements in rats, but there have not been multitudinous studies assessing their safety in humans. One analogous study concerned the 4-wk. supplementation of 710 or 1420 mg of an ellagitanninenriched pomegranate polyphenol extract in 64 fat individualities with an increased waist size and no habitual complaint, and it was observed to be safe and well permitted. In general, pomegranate salutary supplements are safe, with no adverse goods reported in any mortal subjects. Keeping the health benefits of the pomegranate in mind, the routine supplementation of PJ or extracts may help or indeed correct obesity, diabetes, and cardiovascular conditions. Still, as indicated in this review, abating energy input, the intestinal absorption of salutary fats by inhibiting pancreatic lipase, and oxidative stress and inflammation might be important mechanisms for the antiobesity goods of pomegranate food as a whole. The relation of pomegranate constituents to thermogenesis has not been studied with farther constituents of the pomegranate Pomegranate is a food that can be salutary to the mortal body because multitudinous studies have demonstrated its implicit salutary goods. The PJ and pomegranate extracts have a long history of safety, and various pomegranate constituents have been developed as botanical salutary supplements to give an volition and easy form for consumption. Different studies have demonstrated the safety of pomegranate salutary supplements in rats, but there have not been multitudinous studies assessing their safety in humans. One analogous study concerned the 4-wk supplementation of 710 or 1420 mg of an ellagitanninenriched pomegranate polyphenol extract in 64 fat individualities with an increased waist size and no habitual complaint, and it was observed to be safe and well permitted. In general, pomegranate salutary supplements are safe, with no adverse goods reported in any mortal subjects. Keeping the health benefits of the pomegranate in mind, the routine supplementation of PJ or extracts may help or indeed correct obesity, diabetes, and cardiovascular conditions. Still, as indicated in this review, abating energy input, the intestinal absorption of salutary fats by inhibiting pancreatic lipase, and oxidative stress and inflammation might be important mechanisms for the antiobesity goods of pomegranate food as a whole. The relation of pomegranate constituents to thermogenesis has not been studied with farther constituents of the pomegranate.

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