Journal of Medicinal Plants Research Vol. 5(9), pp. 1508-1511, 4 May, 2011
Available online at http://www.academicjournals.org/JMPR
ISSN 1996-0875 ©2011 Academic Journals

Review

The pharmacological activities of prunes: The dried plums

Qaiser Jabeen* and Naveed Aslam

Department of Pharmacy, the Islamia University of Bahawalpur, Pakistan.

Accepted 28 February, 2011

Prunes are dried plums and consumed as food or medicine. *Prunus domestica, Prunus salicina* and *Prunus americana* are the important sources of prunes. Prunes are highly reputed in folk medical practices for nutritive, laxative and digestive properties and used for treatment of hypertension, diabetes, jaundice and fever. The recent studies showed that it has antioxidant, anticancer, anti-hyperglycemic, anti-hyperlipidemic, antihypertensive, anti-osteoporosis, laxative and hepatoprotective activities. Prunes contain dietary fibers, carbohydrates, amino acids, vitamins, minerals and antioxidant polyphenolic phytochemicals. Therapeutically active constituents and their possible mechanisms of actions are also been discussed.

Key words: Prunes, antioxidant, anticancer, antihypertensive, antihyperlipedimeic, osteoporosis, laxative, anxiolytic.

INTRODUCTION

Prunes are considered as healthy food because of lower fat contents and contain considerable amount of important nutrients like carbohydrates, vitamins and minerals. Prunes and prune products also possess medicinal value. Consumption of fruits, like plums and prunes, is useful in blood circulation problems, measles, digestive problems (Li, 2008), in prevention of cancer, diabetes and obesity. Prunes are high in potassium contents and have beneficial effects in cardiovascular problems. Prunes increase the motility of the gastrointestinal tract and have been found to possess laxative activity. A 100 g serving of prunes fulfill, daily requirement of boron. Prune consumption does not immediately raise blood glucose, therefore, beneficial in diabetes (Stacewicz et al., 2001).

Regular consumption of amygdalin containing fruits was considered to have anticancer action (Ferrel, 1998). Recent studies demonstrated that the cancer preventing actions of prunes are associated with its polyphenolic contents and antioxidant activity, which have inhibitory effects on mutagenesis and carcinogenesis.

*Corresponding author. E-mail: qaiserjabeenkhan@yahoo.com, jabeenqaiser@hotmail.com. Tel: +92-300-2540023.

BOTANICAL DESCRIPTION

Botanical origin: *Prunus domestica* L. (European Plum), *Prunus salicina* L. (Japanese Plum), *Prunus Americana* Marsh. (American plum, Marshall's large yellow sweet plum)

Family:	Rosaceae
English name:	Plum
Urdu name:	Alu-Bukhara, Alucha
Part used:	Fruits (Plum or Prunes)

Fleshy fruits of several species of genus Prunus, including that of *P. domestica*, *P. salicina*, *P. americana*, are called Plum. More than 100 species of plum are cultivated in the temperate zones throughout the world since prehistoric times. Commonly, dried plums are called prunes. China is leading plum producing country in the world. Plants are small to medium sized trees. Leaves are ovate or elliptical with acute or obtuse tips, short petioles and crenulate margins. Flowers are small, white and have longer pedicels, mostly born in umbel-like clusters of 2-3 individuals on short spurs, and solitary or 2-3 in axils of 1 year old wood. Fruits are fleshy, oval or round to conical having glaceous surface. Fruits come in variety of colors and sizes.

NUTRITIONAL AND PHYTOCHEMICAL STUDIES

Prunes are significant source of major nutrients, including carbohydrates, several amino acids, vitamin A, vitamin B-complex, vitamin K, potassium, calcium, magnesium, zinc, copper, manganese, selenium, boron and dietary fibers. Prunes fiber consist mainly of soluble fraction (80%) including pectin, hemicellulose, cellulose and lignins. Drying process increases the total dietary fibers (Siddiq, 2006). Sorbitol, glucose, fructose and sucrose are major simple sugars. Malic acid is the predominant acid, although citric, tartaric, benzoic and boric acid were also identified in prunes. Difference in flavors depends upon degree of sourness rather than the degree of sweetness (Jhones and Bulls, 1929). Several volatile components have been isolated from *P. domestica* fruit, out of which benzaldehyde, linalool, ethyl nonanoate, methyl cinnamate and γ-decalactone are found to contribute in plum aroma (Ismail and Williams, 1981). Drying causes disappearance of some volatile components and formation of new componds. Three major compounds identified in dry prunes were benzaldehyde, 2-furancarboxyaldehyde and ethyl cinnamate (Sabarez et al., 2000).

Plums and prunes are rich source of polyphenolic phytochemicals. Total phenolic contents of different plum cultivars have been reported between 282-922 mg/100 g of fruit (Siddiq, 2006). Phenolic compounds of prunes consist mainly of chlorogenic acid, neochlorogenic acid, caffeic acid, coumaric acid, rutin (Donovan et al., 1998) and proanthocyanidin (Kimura et al., 2008). Drying process increases the antioxidant activity due to non-enzymatic reaction products, called melanodins. In prunes, polyphenols contribution in antioxidant activity of prunes is only about 23% of the total antioxidant activity (Madrau et al., 2010).

MEDICINAL AND TRADITIONAL USES

In Unani medicine, prunes are regarded as nutrient, refrigerant, demulcent, cooling, digestive, laxative and tonic. Prunes have been used for centuries in sweet dishes, sauces, rice-meat dish (Biryani). It is used for treatment of acid dyspepsia, nausea, vomiting, to lessen thirst, in bilious fevers and headache. Being somewhat mucilaginous, it cools stomach. Prunes are used in general debility (Usmanghani et al., 1997). Prunes are soaked in a glass of water overnight and the resulting juice is given to patients in morning for the treatment of hypertension (Usmanghani et al., 1986), jaundice and hepatitis (Abbasi et al., 2009). *P. domestica* is used for lowering blood glucose in Elazing Central District of Turkey (Cakilcioglu and Turkoglu, 2009). It is also indicated for the treatment of dysmenorrhea, leucorrhea, miscarriage, asthma and fever (Duke et al., 2002).

PHARMACOLOGICAL ACTIVITIES

Antioxidant activity

Total phenolic contents and total antioxidant capacity of prunes were found higher than other dry fruits including dates, figs and raisins (Wu et al., 2004). Prune extract and juice inhibit oxidation of isolated human LDL (Donovan et al., 1998). Caffeoylquinic acids, hydorxy cinnamic acids, protocatechuic acid, coumarins, lignins and flavanoids present in prunes have high antioxidant activity (Kayano et al., 2004). Methanol elute of water soluble fraction of ethanolic extract of prunes was found to have a novel compound, 4-amino-4-carboxychrome-2-one, which was found to have synergistic action on antioxidant activity of caffeoylquinic acid isomers (Kayano et al., 2002). Neochlorogenic acid and chlorogenic acid isomers in prunes have superoxide anion scavenging activity and inhibit methyl linoleate oxidation (Nakatani et al., 2000). Two liginin glucosides have been isolated from *P. domestica* fruit which have good oxygen radical absorbance activity (Kikuzaki et al., 2004).

Anticancer activity

Ethanol fraction of prune juice has been shown to suppress proliferation and induce apoptotic changes in human colon carcinoma cells (Fujii et al., 2006). Protocatechuic acid in prunes and other fruits has been demonstrated to prevent epithelial cells malignancy in different tissues. The anticancer effects of prunes are probably associated with antioxidant activity of its constituents. Interference with metabolic activation of carcinogens or direct blocking of carcinogen binding with DNA molecules resulting in mutation and neoplastic transformation may also be involved in anticancer activity of protocatechuic acid (Tanaka et al., 2011).

Antihyperlipidemic activity

Daily ingestion of prunes has shown to decrease plasma and LDL cholesterol in mild hypercholesterolemic persons (Tinker et al., 1991). Prune fibers decreased plasma and liver cholesterol in hyperlipidemic rats (Tinker et al., 1994). *In vitro* binding of bile acids with prunes was compared with other fruits and cholestyramine. Total polysacchrides of prunes were found to process 50% bile acid binding capacity of cholestyramine (Kahlon and Smith, 2007). Dried prunes supplementation at level of 9.5% prevents athereosclerosis in apoprotein-E deficient mouse in high cholesterol diet (Gallaher and Gallaher, 2009). Therefore, daily ingestion of prunes may be helpful in atherosclerosis amelioration through lipid and lipoprotein lowering actions.

Blood pressure lowering activity

Caffeic acid decreased reactive oxygen species in angiotensin-II treated vascular smooth muscle cells obtained from stroke prone spontaneously hypertensive rats (SHRSP) and chronic administration of prunes extract hampered elevation of blood pressure in SHRSP (Neigeshi et al., 2007).

Use in age-related cognitive deficits

Regular supplementation of plum juice in rats is effective in mitigating age- related cognitive deficits, which may be attributed to antioxidant activity of plum juice (Shukitt et al., 2009).

Anxiolytic activity

In mouse models of anxiety, chlorogenic acid, in a dose of 20 mg/Kg has anxiolytic effect, which may be mediated through activation of benzodiazepine receptors (Bouayed et al., 2007). Recently, oxidative stress in brain is implicated in pathogenesis of anxiety disorders (Bouayed et al., 2009). Prunes may be beneficial in anxiety disorders due to chlorogenic acid contents and ability to improve in antioxidant defense.

Good for bones

Prunes are very effective in preventing or reversing bone loss (Hooshmand and Arjmandi, 2009). Prunes are rich source of selenium and boron. Both of these trace elements modulate bone metabolism and preserve bone mineral density. Prunes prevented ovariectomy induced loss in bone mineral density in female rats. Inclusion of prunes in diet reversed bone loss in ovarian hormone deficient rats, in orchidectomized male rats (Bu et al., 2007) and in adult and aged male mice (Halloran et al., 2010). Prunes and its polyphenols decrease bone resorption by suppressing nuclear receptor activator for NF-κB ligand (RANKL) signaling by osteoblasts, which in-turn down-regulates osteoclast differentiation and activity. The prunes polyphenols also increase osteoblast activity and function in-vitro, which was associated with up-regulation of key transcription factors and growth factors involved in osteoblast differentiation and collagen crosslinking respectively (Smith, 2007) and direct inhibition of osteoclastogenesis by down-regulating nuclear factor for activated T cells (NFATc1) and inflammatory mediators (Bu et al., 2008). In postmenopausal women, prunes supplementation increased bone formation and decreased resoprtion, thus decreasing risk of osteoporotic fractures (Arjmandi, 2001; Hooshmand and Arjmandi, 2009).

Useful in constipation and liver disorders

The prunes were reported to contain oxyphenisatin, which has been shown to act as contact laxative (Ritchie, 1972). High sorbitol contents and cholorogenic acids also contribute to laxative effect of prunes (Stacewicz et al., 2001). In a randomized, double blind crossover study, 260 g /day consumption of yoghurt containing galacto-oligosaccharides (12 g/day), prunes (12 g/day) and linseed (12 g/day) reduced the severity of constipation in elderly subjects with mild constipation (Sairanen et al., 2007). Daily ingestion of prune juice by human volunteers was found to have mild laxative effect (Piirainenad et al., 2007) and significant reduction in serum activities of alanine transaminase and serum alkaline phosphatase (Ahmed at al., 2010). Therefore, prune juice may be useful as mild laxative and beneficial in hepatic diseases.

Toxicity

The eatable portion of prunes is non-toxic. Seeds contain cyanogenic glycosides; amygdalin and prunasin, which upon hydrolysis, release toxic hydrogen cyanide. These glycosides are not hydrolyzed and remain confined in seeds until cell are not damaged. Consumption of improperly processed food containing plum or prunes can cause cyanide poisoning (Vetter, 2000).

Contraindications

There is no report of adverse effects. Many people may have avoided consuming dried plum due to reported laxative effects. But studies demonstrated that consumption of prunes in daily diet up to 100 g by men and postmenopausal women did not significantly change their bowel habits (Tinker et al., 1991; Lucas et al., 2004).

CONCLUSION

Prunes have been found pharmacologically active as antioxidant, anticancer, anxiolytic, mild laxative and antihyperlipedimic. Their efficacy in treatment and prevention of hypercholesterolemia and osteoporosis has been documented in clinical studies. It exerts positive effects on cardiovascular parameters possibly through anti-oxidant activities, high fiber and potassium contents. In conclusion, prunes have wide range of nutritional and medicinal uses and daily consumption can be beneficial in the treatment or prevention of different ailments.

REFERENCES

Abbasi AM, Khan MA, Ahmad M, Zafar M, Khan H, Muhammad N,

Sultana S (2009). Medicinal plants used for the treatment of jaundice and hepaptitis based on socio-economic documentation. Afr. J. Biotechnol., 8: 1643-1650.
Ahmed T, Sadia H, Khalid A, Batool S, Janjua A (2010). Report: prunes and liver function: a clinical trial. Pak. J. Pharm. Sci., 23: 463-466.
Arjmandi BH (2001). The role of phytoestrogens in the prevention and treatment of osteoporosis in ovarian hormone deficiency. J. Am. College Nutri., 20: 398S-402S.
Bouayed J, Rammal H, Dicko A, Younos C, Soulimani R (2007). Chlorogenic acid, a polyphenol from *Prunus domestica* (Mirabelle), with coupled anxiolytic and antioxidant effects. J. Neurol. Sci., 262: 77-84.
Bouayed J, Rammal H, Soulimani R (2009). Oxidative stress and anxiety, relationship and cellular pathways. Oxid. Med. Cell Longev., 2: 63-67.
Bu SY, Lerner M, Stoecker BJ, Boldrin E, Brackett DJ, Lucas EA, Smith BJ (2008). Dried plum polyphenols inhibit osteoclastogenesis by downregulating NFATc1 and inflammatory mediators. Calcif. Tissue Int., 82: 475-488.
Bu SY, Lucas EA, Franklin M, Marlow D, Brackett DJ, Boldrin EA, Devareddy L, Arjmandi BH, Smith BJ (2007). Comparison of dried plum supplementation and intermittent PTH in restoring bone in osteopenic orchidectomized rats. Osteoporosis Int., 18: 931-942.
Cakilcioglu U, Turkoglu I (2009). Plants used to lower blood sugar in Elazig Central District. Acta Hortic. (ISHS), 826: 97-104.
Donovan JL, Meyer AS, Waterhouse AL (1998). Phenolic composition and antioxidant activity of prunes and prune juice (*Prunus domestica*). J. Agric. Food Chem., 46: 1247-1252.
Duke JA, Bogenschutz GMJ, Du CJ, Duke PK (2002). Handbook of Medicinal Herbs. CRC Press, USA, p. 577.
Ferrel V (1998). Alternative cancer remedies - Facts from histories and medical researches. Pligrims Books, USA, pp. 117-130.
Fujii T, Ikami T, Xu J, Ikeda, K (2006). Prune extract (*Prunus domestica* L.) supresses the proliferantion and induces apoptosis of human colon carcinoma Caco-2. J. Nutr. Sci. Vitaminol., 52: 389-391.
Gallaher CM, Gallaher DD (2009). Dried plums (prunes) reduce atherosclerosis lesion area in apolipoprotein E-deficient mice. Br. J. Nutr., 101: 233-239.
Halloran BP, Wronski TJ, VonHerzen DC, Chu V, Xia X, Pingel JE, Williams AA, Smith BJ (2010). Dietary Dried Plum Increases Bone Mass in Adult and Aged Male Mice. J. Nutr., 140: 1781-1787.
Hooshmand H, Arjmandi BH (2009). Dried plum, an emerging functional food that may effectively improve bone health. Ageing Res. Rev., 8: 122-127.
Ismail HM, Williams AA (1981). The flavour of plums (*Prunus domestica* L.). An examination of the aroma components of plum juice from the cultivar victoria. J. Agric. Food Chem., 32: 613-619.
Jhones JS, Bullis DE (1929). The chemical composition and food value of Oregon dried prunes. Agric. Exp. Station Bull., 249: 1-10.
Kahlon TS, Smith GE (200*7). In vitro* binding of bile acids by blueberries (*Vaccinium* spp.), plums (*Prunus* spp.), prunes (*Prunus* spp.), strawberries (*Fragaria Xananassa*), cherries (*Malpighia punicifolia*), cranberries (*Vaccinium macrocarpon*) and apples (*Malus sylvestris*). Food Chem., 100: 1182-1187.
Kayano SI, Kikuzaki H, Fukutsuka N, Mitani T, Nakatani N (2002). Antioxidant activity of prune (*Prunus domestica* L.) constituents and a new synergist. J. Agric. Food Chem., 50: 3708-3712.
Kayano SI, Kikuzaki H, Yamada NF, Aoki A, Kasamatsu K, Yamasaki Y, Ikami T, Suzuki T, Mitani T, Nakatani N (2004). Antioxidant properties of prunes (*Prunus domestica L.*) and their constituents. BioFactors, 21: 309-313.
Kikuzaki H, Kayano S, Fukutsuka N, Aoki A, Kasamatsu K, Yamasaki Y, Mitani T, Nakatani N (2004). Abscisic acid related compounds and lignins in prunes (*Prunus domestica* L.) and their oxygen radical absorbance capacity (ORAC). J. Agric. Food Chem., 52: 344-349.
Kimura Y, Ito H, Kawaji M, Ikami T, Hatano T (2008). Characterization and antioxidative properties of oligomeric proanthocyanidin from prunes, dried fruit of *Prunus domestica* L. Biosci. Biotechnol. Biochem., 72: 1615-1618.
Li TSC (2008). Vegetables and fruits: nutritional and therapeutic values. Taylor and Francis Group, USA, pp. 169,195, 198, 202-203.
Lucas EA, Hammond LJ, Mocanu V, Arquitt AB, Trolinger A, Khalil DA, Smith BJ, Soung DY, Daggy BP, Arjamandi BH (2004). Daily consumption of dried Plum by postmenopausal women does not cause undesirable changes in bowel function. J. Appl. Res., 4: 37-43.
Madaru MA, Sanguinetti AM, Caro AD, Fadda C, Piga A (2010). Contribution of melanoidins to the antioxidant activity of prunes. J. Food Qual., 33: 155-170.
Nakatani N, Kayano S, Kikuzaki H, Sumino S, Katagiri K, Mitani T (2000). Identification, quantitative determination and antioxidative activities of Chlorogenic acid isomers in Prune (*Prunus domestica* L.). J. Agric. Food Chem., 48: 5512-5516.
Negishi H, Onobayashi Y, Xu JW, Njelekela, MA, Kobayakawa A, Yasui N, Yamamoto J, Ikami T, Ikeda K, Yamori Y (2007). Effects of prune extract on blood pressure elevation in stroke-prone spontaneously hypertensive rats. Clin. Exp. Pharmacol. Physiol., 34: S47-S48.
Piirainenad L, Peuhkurib K, Backstromb K, Korpelabcd R, Salminene S (2007). Prune juice has a mild laxative effect in adults with certain gastrointestinal symptoms. Nutr. Res., 27: 511-513.
Ritchie J (1972). Mass peristalsis in the human colon after contact with oxyphenisatin. Gut, 13: 211-219.
Sabarez HT, Price WE, Korth J (2000). Volatile changes during dehydration of d'Agen prunes. J. Agric. Food Chem., 48: 1838-1842.
Sairanen U, Piirainen L, Nevala R, Korpela R (2007). Yoghurt containing galacto-oligosaccharides, prunes and linseed reduces the severity of mild constipation in elderly subjects. Eur. J. Clin. Nutr., 61: 1423-1428.
Shukitt HB, Kalt W, Carey AN, Vinqvist-Tymchuk M, McDonald J, Joseph JA (2009). Plum juice, but not dried plum powder, is effective in mitigating cognitive deficits in aged rats. Nutrition, 25: 567-573.
Siddiq M (2006). Plums and Prunes. In Hui, YH (ed) Handbook of Fruits and Fruit Processing. Blackwell Publishing Professional, Lowa, pp. 553-564.
Smith BJ (2007). Dried plum improves bone density and microarchitecture by up-regulating osteoblast activity and down-regulating osteoclast differentiation. Acta Hort. (ISHS). 841: 441-448.
Stacewicz SM, Bowen PE, Hussain EA, Damayanti WBI, Farnsworth NR (2001). Chemical composition and potential health effects of prunes: a functional food. Crit. Rev. Food. Sci. Nutr., 41: 251-286.
Tanaka T, Tanaka T, Tanaka M (2011). Potential cancer chemopreventive activity of protocatechuic acid. J. Exp. Clin. Med., Article in press.
Tinker LF, Davis PA, Schneeman BO (1994). Prune fiber or pectin compared with cellulose lowers plasma and liver lipids in rats with diet-induced hyperlipidemia. J. Nutr., 124: 31-40.
Tinker LF, Schneeman BO, Davis PA, Gallaher DD, Waggoner CR (1991). Consumption of prunes as a source of dietary fiber in men with mild hypercholesterolemia. Am. J. Clin. Nutr., 53: 1259-1265.
Usmanghani K, Honda G, Miki W (1986). Herbal drugs and herbalists in Pakistan. Institute for the study of languages and cultures of Asia and Africa, Japan, p. 48.
Usmanghani K, Saeed A, Alam MT (1997). Indusyunic Medicine. Department of Pharmacognosy, Faculty of Pharmacy, University of Karachi, Pakistan, pp. 363-364.
Vetter J (2000). Plant cyanogenic glycosides. Toxicon., 38: 11–36.
Wu X, Beecher GR, Holden JM, Haytowitz GB, Gebhardt SE, Prior RL (2004). Lipophilic and hydrophilic antioxidant capacities of common foods in the United States. J. Agric. Food Chem., 52: 4026-4037.