Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
https://www.phytojournal.com
JPP 2024; 13(4): 26-32
Received: 17-04-2024
Accepted: 25-05-2024

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A review on pharmacological studies and properties of Aloo Bukhara: *Prunus domestica* Linn

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DOI: https://doi.org/10.22271/phyto.2024.v13.i4a.14992

Abstract
Prunus domestica, commonly known as Aloo Bukhara, Prunes, or European Plum, is a member of the Rosaceae family renowned for its widespread cultivation in temperate regions. India stands as the second-largest producer of plums globally, emphasizing its agricultural and economic significance. Phytochemical analyses reveal the presence of flavonoids, phenolic compounds, and various bioactive constituents within *Prunus domestica*. This review consolidates current knowledge on its morphology, drawing insights from Unani literature, and synthesizes findings from phytochemical studies. Furthermore, the review elucidates the diverse therapeutic potential of *Prunus domestica*, including its antioxidant, hepatoprotective, anticancer, antidiabetic, anti-inflammatory, anti-allergic, antihypotensive, antihyperlipidemic, and anxiolytic properties. This comprehensive overview underscores the multifaceted significance of *Prunus domestica* in traditional medicine and modern pharmacology, highlighting avenues for further research and application.

Keywords: Aloo Bukhara, prunes, *Prunus domestica*, phytochemistry, pharmacognosy

Introduction
Plum (*Prunus domestica*), also known as European plum, is an edible fruit belonging to family Rosaceae within the genus Prunus and sub family Amygdaloideae. Although plum is the commercial fruit of countries like Japan and America, its origin is traced to China. Now-a-days, plums are widely cultivated around the temperate regions of the world [1] Plum grows well under temperate climatic conditions. India is the second largest producer of plums worldwide. The fruit is low in calories but contains nutrients like minerals, vitamins and phytochemicals in profuse amounts [2]. Between 19 and 40 different species of plum exist. Of these, only 2, the hexaploid European plum (*Prunus domestica*) and the diploid Japanese plum (Prunus salicina and hybrids), are of commercial significance across the globe [3] The European plum is believed to have been discovered about 2000 years ago, with its origin somewhere near the Caspian Sea. The fruit was introduced into the USA in the 17th century by pilgrims. Today, the main producers of commercially grown plums are the United States, Serbia, China and Romania [4].

Fig 1: Prune plum

Description of drug in unani literature

Aloo Bukhara a sour fruit which is abundantly found in Kashmir, Afghanistan, Iran, and Pakistan. Fresh fruits are reddish and dried plums are black in colour [5]. According to Jalinoos, fruits that are big and soft are considered to be best, and the fruits which are small, hard and bitter in taste are not good. These fruits are considered to be laxative. Dried plums of Damascus are considered to be beneficial for the stomach (Dioscorides) [6] Fruits are of two types [6, 7, 8]. Black and white, only black coloured fruit is called as Aloo Bukhara while, white type is called as Shahlooj (Ishaq bin sulaiman) [6, 8].

Vernacular names [6, 7, 8]

Arabic - Ijjaz
Persian - Aloo Bukhara, Shahlooj.
English - Prune [9].
Other names - Ain ul Baqr, Barqooq.

Habitat

It is assumed to have originated in south-Eastern Europe (Caucasus) and southwestern Asia. In the Canaries, as well as being widely cultivated on almost all the islands, it has also become established in the wild on Tenerife and Gran Canaria. Pakistan, West Asia to Europe [10, 11].

Description

Fig 2: Macroscopic

A small deciduous tree with rounded crown which grows to a height of about 6 to 15 m. It is usually thorn less and has a scaly dark brown bark. The leaves are simple and elliptic about 4 to 10 cm in length and are a matt dark green above and a lighter green below, turning yellow, orange or red in the autumn. The flowers are white or greenish white that are about 1 to 2.5 cm in diameter, that usually grows solitary or in pairs [12].

The macroscopic observations for *P. domestica* fruit revealed to have a blackish-brown color and an oval shape. The size of the fruit ranges from 6-8 cm in diameter and the surface is smooth. The odor of the fruit is delicious, and the taste is sweet to acidic [13].

The skin of the plum is coated with a natural waxy layer/bloom which gives the fruit a glaucous appearance. Volatile compounds like benzaldehyde, cinnamate, linalool, ethyl nonanoate are responsible for the aroma of fruit. However, wax bloom contains alkanes and alcohols that are responsible for flavor [15].

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.

Microscopic

The transverse section of the fruit revealed an abundance of the rectangular-shaped parenchymatous cells in its ground tissue, thin-walled epidermis devoid of cuticle and any kind of excrescences, and uniformly distributed coloring matter possessing vascular bundles of xylem and phloem [13].

Phenology: Flowers bloom during February to April. Fruits ripe during August to September [12].

Temperament (MIZAJ): Cold and Moist [5, 6, 7, 8].

Scientific classification [12, 14]

- Kingdom-Plantae
- Division-Tracheophyta
- Class-Magnoliopsida
- Order-Rosales
- Family-Rosaceae
- Sub family- Amygdaloideae
- Genus-Prunus
- Species-*Prunus domestica* L.

Phytochemical constituents [17]

Flavonoids	Phenolic Compounds	Other Compounds
• Cyanidin-3-glucoside • Cyanidin-3-rutinoside • Cyanidin-3-xyloside • Peonidin-3-rutinoside • Peonidin-3-glucoside • Catechin • Epicatechin • Procyanidin B1 • Procyanidin B2 • Epicatechin 3-*O*-gallate • Proanthocyanidin oligomer • Epicatechin-4,8′-epicatechin-4′,8″-epicatechin • Epicatechin-4,8′-epicatechin-(2′*α*⟶*O*⟶7″; 4′*α*⟶8″)-epicatechin • Quercetin	• Vanillic acid • Protocatechuic acid • p-Hydroxybenzoic acid • Vanillic acid-β-glucoside • Vanillic acid-α-D-glucopyranoside • Gallic acid • Syringic acid • Caffeic acid • Caffeic acid methyl ester • Ferulic acid • p-Coumaric acid • Cinnamic acid • Ferulic acid-β-D-glucopyranoside • Coniferine • 3-O-Caffeoylquinic acid (neochlorogenic acid) • 4-O-Caffeoylquinic acid	• *p*-Hydroxybenzaldehyde • Benzoic acid • Syringaldehyde • Hydroxy-4-methoxybenzaldehyde • Vanillin • Coniferyl aldehyde • Dimethoxycinnamaldehyde • Amygdalin • Coniferyl aldehyde • Pinoresinol-*O*-*α*-D-glucopyranoside • Guajacyl-glycerin-coniferyl aldehyde-1 • Guajacyl-glycerin-coniferyl aldehyde-2 • Dehydro-diconiferyl aldehyde • Fumaric acid • Malic acid • Succinic acid • Citric acid

- Quercetin-3-rutinoside
- Quercetin-3-*O*-glucoside
- Quercetin-3-*O*-arabinoside
- Quercetin-3-*O*-rhamnoside
- Quercetinl-7-*O*-*α*-L-rhamnopyransoide 32
- Quercetin-3-*O*-*β*-D-galactoside
- Quercetin-Quercetinl-7-*O*-*α*-L-rhamnopyransoide
- Quercetinl-7-*O*-*α*-L-rhamnopyransoide
- Quercetin-3-*O*-*β*-D-galactoside
- Quercetin-Quercetinl-7-*O*-*α*-L-rhamnopyransoide
- Quercetin-3-*O*-*β*-D-galactoside
- Quercetin
- 3-*O*-*α*-D-xylopyranoside
- Quercetin-3-*O*-*α*-D-glucopyranoside
- Quercetin-pentoside
- Quercetin-pentoside-rhamnoside
- Quercetin pentosyl-hexoside
- Quercetin-acetylhexoside
- Quercetin-deoxyhexose
- Quercetin-3-*O*-(4″-*O*-*β*-D-glucopyranosyl)-*α*-L-rhamnopyransoide
- 5,4′-Dihydroxyflavone-7-*O*-*α*-D-glucoside
- Kaempferol-hexoside
- Kaempferol-pentoside-rhamnoside
- Kaempferol-pentoside
- Myricetin
- Prudomestin
- 3,5,7-Trihydroxy-4′-methoxyflavanone
- Isorhamnetin-3-*O*-rutinoside
- Isorhamnetin-3-*O*-glucoside
- Isorhamnetin-3-*O*-galactoside
- Quercetin-4′-*O*-*α*-D-glucoside
- Isosakuranetin
- Dihydrokaempferide
- Naringenin
- 3,5,7-Trihydroxy-8,4′-dimethoxyflavanone
- 3,5,7-Trihydroxy-6,4′-dimethoxyflavanone
- 5,7,4′-Trihydroxy-3-methoxyflavanone
- 7,4′-Dimethylaromadendrin
- 5,7-Dihydroxy-4′-methoxy-dihydroflavonol
- 5,7-Dihydroxy-8,4′-dimeth-oxyllavonol
- Prudomestiside A
- Prudomestiside B
- Purupuside A
- 5-O-Caffeoylquinic acid
- 3-O-Caffeoylquinic acid methyl ester
- 4-O-Caffeoylquinic acid methyl ester
- 5-O-Caffeoylquinic acid methyl ester
- 3-O-Feruloylquinic acid
- 3-O-Coumaroylquinic acid
- 3-Coumaroylquinic acid methyl ester
- Salicylic acid
- 2,3-Dimethylbenzoic acid
- Shikimic acid
- 3-Caffeoylshikimic acid
- Ellagic acid
- Caffeoyl hexoside
- p-Coumaroyl-hexoside
- 3,4-Dihydroxybenzoyl-glucoses
- Rosmarinic acid
- Abscisic acid
- β-D-glusosylabscisate
- Rel-5-(1R,5S-dimethyl-3R,4R,8S-trihydroxy-7-oxabicyclo (3,2,1)-oct-8-yl)-3-methyl-2Z,4E-pentadienoic acid
- Rel-5-(1R,5S-dimethyl-3R,4R,8S-trihydroxy-7-oxa-6-oxobicyclo (3,2,1) oct-8-yl)-3-methyl-2Z,4E-pentadienoic acid
- Rel-5-(3S,8S-dihydroxy-1R,5S-dimethyl-7-oxa-6-oxobicyclo (3,2,1) oct-8-yl)-3-methyl-2Z,4E-pentadienoic acid
- Rel-5-(3S,8S-dihydroxy-1R,5S-dimethyl-7-oxa-6-oxobicyclo s oct-8-yl)-3-methyl-2Z,4E-pentadienoic acid-3′-O-α-D-glucopyranoside
- (6S,9R)-roseoside
- Vitamin C
- 2-(5-Hydroxymethyl-2′,5′-dioxo-2′,3′,4′,5′-tetrahydro-1′H-1,3′-bipyrrole)-carbaldehyde
- Hydroxymethylfurfural
- Benzyl-*β*-primeveroside
- Vanillin diglucoside
- 4-Amino-4-carboxychroman-2-one
- *β*-Sitosterol
- 3-(*α*-D-glucopyranosyloxymethyl)-2-(4-hydroxy-3-methoxyphenyl)-5-(3-hydroxypropyl)-7-methoxy-(2*R*,3*S*)-dihydrobenzofuran
- 5,7-Dimethoxy-6-hydroxy-coumarin
- 7-Methocycoumarin
- Esculin
- Scopolin
- Scopoletin
- Magnolioside
- 6,7-Methylenedioxy-8-methoxycoumarin
- (3-*O*-*cis*-p-Coumaroyl-*α*-D-fructofuranosyl)-(2⟶1)-*α*-D-glucopyranoside
- (3-*O*-*trans*-p-Coumaroyl-*α*-D-fructofuranosyl)-(2⟶1)-*α*-D-glucopyranoside
- 2,7-Dimethyl-2*E*,4*E*-octadienedioic acid
- *α*-D-Glucopyranosyl 7-carboxy2-methyl-2*E*,4*E*-octadienate
- 1*S*-(4-*α*-D-glucopyranosyl-3-methoxyphenyl)-2*R*-[4-(3-hydroxypropyl)-2-methoxyphenoxy]-1,3-propanediol
- *α*-D-glucopyranosyl 9-carboxy-8-hydroxy-2,7-dimethyl-2*E*,4*E*-nonadienate
- 8-Hydroxy-2,7-dimethyl-2*E*,4*E*-decadienedioic acid 1-*α*-D-glucopyranyl ester 10-Methyl ester
- *α*-D-glucopyranosyl cinnamate
- (-)-Dihydrodehydrodiconiferyl alcohol
- (-)-Ficusal
- (*E*)-3, 3′-dimethoxy -4,4′-dihydroxystilbene

• Purunuside B • Purunuside C • Prunusins A • Prunusins B • Phloridzin • 5,2′-Dihydroxy-7,5′-dimethoxyflavanone		

Functions [5, 6, 7, 8, 16]
Musakin e Safra o khoon (Calming agent).
Mulayyan (Laxative).
Muratib (Humidifying agent).
Mushil e safra (Purgative).

Therapeutic Uses [5, 6, 7, 8, 16]
Qai (Vomiting).
Matli (Nausea).
Excessive thirst.
Hararath o sozij badan (Excessive heat).
Safrawi aur khooni bukhar.
Sarsaam (Migrane).

Pharmacological studies activities proven

Antioxidant activity
The phenolic compound in food usually acts as antioxidants for low-density lipoproteins. A major amount of cholinergic acid and noncholinergic acid were found when commercial prune and prune juice extracts were analyzed using reversed-phase HPLC with diode array detection and these compounds are responsible to inhibit the oxidation of low-density lipoprotein (LDL) [18] Fresh samples of ethanolic and methanolic extracts of *Prunus domestica* have more antioxidant capacity than the dried one [19] The 4-o-caffeoylquinic acid along with 28 other isolated compounds including coumarin, flavonoids, hydroxycinnamic acid, lignans, and benzoic acid have shown high antioxidant properties when measured by oxygen radical absorbance capacity [20].

Hepatoprotective activity
Rutin has been known to target the initial phase of infection With the Hepatitis C virus (HCV) that is preventing the entry of HCV in hepatic cells significantly (~62%) by inhibiting the binding of labeled HCV-LPs to Huh 7 cells of the liver. It has proved to be nontoxic to hepatocytes even at high concentrations [21]. A significant reduction in the level of serum alanine transaminase and serum alkaline phosphatase was reported in a clinical trial by 166 healthy human volunteers [22].

Hypotensive activity
Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Ambulatory Blood Pressure (MABP) was decreased in normotensive anesthetized rats when given intravenous administration of crude extract of *Prunus domestica* but it has a dose-dependent effect [23]. *Prunus domestica* has been shown to modify the intracellular calcium concentration which results in negative ionotropic and chronotropic effects which could be responsible for lowering blood pressure. These cardioprotective effects may be attributed to the high levels of phenolic compounds present in Prunus [24].

Antihyperlipidemic activity
Plum juice is shown to be associated with a higher abundance of intestinal microbiota especially lactobacillus when administered by obese animal models and this effect can be attributed to its antihyperlipidemic effect because obesity is thought to be related to reduced bacterial diversity [25] When polyphenolic compounds were isolated from *Prunus domestica* red and yellow and tested *in-vitro* for antihyperlipidemic activity results showed that *Prunus domestica* red has a greater hyperlipidemic effect than *Prunus domestica* yellow [26].

Anticancer activity
During the exploration of the multi-target therapeutic potential of Prunus, Domestica gum loaded nanoparticles in different *in vitro* and *in vivo* testing paradigms both the gold and silver nanoparticles were found to be the selective inhibitors of cancer cells [27] Plum wine has shown a significant cytotoxic effect on the growth of three tested cancer cell lines (Hep2c, RD, and L2OB) [28] Chlorogenic acid has been demonstrated to exhibit the maximum antiproliferative activity on MDA-MB-468 human breast cancer cell line [29] A study was conducted to identify the phenolic fraction responsible for the potential chemopreventive and/or chemotherapeutic actions in plum. All extract fractions were found effective in exerting an antioxidant effect on studied cancer cell lines with the flavonols and procyanidins more effective than the phenolic acids and anthocyanins [30].

Anxiolytic activity
Chlorogenic acid, a polyphenol from *Prunus domestica* has been shown to cause the activation of benzodiazepine receptors at the dose of 20mg/kg thereby inducing a decrease in anxiety related behaviors [31].

Effects on gastrointestinal tract
Upon administration of prune juice for 4 study weeks, a mild laxative effect was reported in adults with certain gastrointestinal symptoms however increase in flatulence was also observed [32] Oxyphenisetin, a reported constituent of prune, has been shown to act as a contact laxative [33]. After the consumption of yogurt containing galactooligosaccharides (12 g/day), prunes (12 g/day), and linseed (12 g/day), the severity of constipation was reduced in elderly subjects with mild constipation during a double-blind crossover study [34]. The laxative effect was attributed to a synergistic effect provided by sorbitol, dietary fiber and polyphenols [35].

Antidiabetic activity
Purunusides A-C, new homoisoflavone glucosides, isolated from *Prunus domestica*, has been reported as a potent inhibitor of enzyme alpha-glucosidase [36]. In alloxan-induced diabetic rats, the methanolic extract of *Prunus domestica* has shown significantly reduced the levels of blood glucose after 14 days of treatment [37].

Bone density: Prunes are reported to be effective in preventing and reversing bone loss [38] In a randomized study,

consumption of either 100g dried plums or 75 g dried apples daily for 3 months, only dried plums significantly increased serum levels of insulin-like growth factor-I (IGF-I) and bone-specific alkaline phosphatase (BSAP) activity in menopausal women. Higher levels of both are associated with greater rates of bone formation [39]. Dried plums have been reported to be effective in restoring femoral and tibial and lumbar bone density osteopenic ovariectomized rats [40].

Antibacterial activity: When the antibacterial assay was performed for *Prunus domestica* using the diffusion method, the results showed that it affects both gram positive and negative bacteria equally. The best inhibition activity at the concentration of 10 µg/mL was found to be against Escherichia coli growth [41]. Ethyl acetate extract of *Prunus domestica* was reported to have the highest antibacterial activity while ethyl alcohol extract showed the least antibacterial activity during a screening of solvent dependent antibacterial activity using the agar well diffusion method [42].

Effect on learning and memory: The hydroalcoholic extract of plum has shown a beneficial effect on the learning and memory of mice due to its antioxidant properties during the passive avoidance task [43, 44].

Anti-inflammatory activity

The dry extract from *Prunus domestica* fruits containing fibers has been reported to show anti-cyclooxygenase, anti-lipoxygenase, and antioxidative properties [45] Dried plum polyphenols at a dose of 1000 µg/mL were found to be able to reduce the production the pro-inflammatory markers, nitric oxide (NO), and cyclooxygenase-2 (COX-2) inactivated macrophage RAW 264.7 cells, thus showed strong anti-inflammatory activity [46, 47].

Anti-allergic

Plum extracts have shown to lessen allergen immunoglobulin E levels. Prunes and plum extract can inhibit the growth of various bacteria (Bacillus cereus, Staphylococcus aureus) due to the polyphenol and flavonoid content [48].

Toxicology

There are no toxicological reports available for *Prunus domestica* to date. The edible portion of the fruit is non-toxic and safe for consumption. However, the seeds contain cyanogenic glycosides, specifically amygdalin and prunasin. Upon hydrolysis, these glycosides release hydrogen cyanide. Despite this, the glycosides generally remain enclosed within the seeds and are not hydrolyzed unless the cells containing them are damaged It is important to note that improperly processed food containing plums can potentially cause cyanide poisoning if consumed [49].

Posology (Meqdar Khuraak)

15 to 20 counts [8].

Adverse effect/side effect (MUZIR)

It has adverse effect on brain, stomach and cold temperament people [6, 8, 16].

Corrective (MUSLEH) [8, 16]

Unnab (*Ziziphus jujuba*).
Mastagi (*Pistacia lentiscus*).
Shahed (Honey).
Maul asl (Honey water).
Gulkhand.

Substitute (BADAL)

Imli (Tamarindus Indica) [16].

Conclusion

The chemical, pharmacological, and clinical studies summarized in this review demonstrate the therapeutic potential of *Prunus domestica*. This plant has been documented to possess anti-hypertensive, anti-hyperlipidemic, and anti-osteoporotic properties. Key active chemical compounds such as chlorogenic acid, neochlorogenic acid, and caffeic acid indicate that *Prunus domestica* could be a promising candidate for the development of new drugs targeting these disorders. Therefore, further human trials and in-depth investigations are necessary to fully assess its potential in disease prevention and treatment.

References

1. Blazek J. A survey of the genetic resources used in plum breeding. In: VIII International Symposium on Plum and Prune Genetics, Breeding and Pomology. 2004 Sep;734:31-45.
2. Hussain SZ, Naseer B, Qadri T, Fatima T, Bhat TA. Plum (*Prunus domestica*): Morphology, Taxonomy, Composition and Health Benefits. In: Fruits Grown in Highland Regions of the Himalayas. Springer, Cham; c2021. Available from: https://doi.org/10.1007/978-3-030-75502-7_13
3. Topp BL, Russell DM, Neumüller M, Dalbó MA, Liu W. Plum. In: Fruit Breeding. Springer: New York; c2012.
4. UN Food and Agriculture Organization. Production of Plum by Countries; c2011 [cited 2015 Jan 6]. Available from: http://faostat3.fao.org/
5. Safiuddin AS. Unani Advia Mufrada. Qawmi Council Barae Farogh Urdu Zaban; c2010. p. 53.
6. Ibn Baitar. Al Jamiul mufradat al advia al aghzia. Vol I. New Delhi: CCRUM.
7. Kabiruddin M. Makhzanulmufradat. New Delhi: Ejaz Publishing House; c2000.
8. Ghani NHM. Khazainul Advia. Vol 1. New Delhi: Idara Kitab Us Shifa; c2011.
9. Khare CP. Indian Medicinal Plants. New York, USA: Springer Science; c2007. p. 521.
10. Sultana N, Rehman H, Muntaha STM, Haroon Z, Fatima D, Fakhra H, *et al*. *Prunus domestica*: A review. Asian Journal of Pharmacognosy. 2021;4(3):21-29.
11. Zhebentyayeva T, Shankar V, Scorza R, *et al*. Genetic characterization of worldwide *Prunus domestica* (plum) germplasm using sequence-based genotyping. Horticulture Research. 2019;6:12.
12. Komor P, Devi OS. Edible Bioresources & Livelihoods. Assam State Biodiversity Board, Guwahati; c2016. p. 247.
13. Amir M, Zafar A, Ahmad R, *et al*. Quality control standardization, contaminant detection and *in vitro* antioxidant activity of *Prunus domestica* Linn. fruit. Plants (Basel). 2022 Mar 6;11(5):706. DOI: 10.3390/plants11050706. PMID: 35270176; PMCID: PMC8912893.
14. Bahrin AA, Moshawih S, Dhaliwal JS, *et al*. Cancer protective effects of plums: A systematic review. Biomedicine & Pharmacotherapy. 2022 Feb;146:112568.

15. Somogai LP. Plums and prunes processing. In: Fruits Science and Technology. 2nd ed. CRC Press; c2005. p. 513-530.
16. Hakim MA. Bustanul Mufradat. 1st ed. Delhi: Zafar Book Depot; c1999.
17. Liu W, Nan G, Nisar MF, Wan C. Chemical constituents and health benefits of four Chinese plum species. Journal of Food Quality. 2020;2020:8842506. DOI: 10.1155/2020/8842506.
18. Donovan JL, Meyer AS, Waterhouse AL. Phenolic composition and antioxidant activity of prunes and prune juice (*Prunus domestica*). Journal of Agricultural and Food Chemistry. 1998;46(4):1247-1252.
19. Morabbi Najafabad A, Jamei R. Free radical scavenging capacity and antioxidant activity of methanolic and ethanolic extracts of plum (*Prunus domestica* L.) in both fresh and dried samples. Avicenna Journal of Phytomedicine. 2014;4(5):343-353.
20. Kayano S, Kikuzaki H, Yamada NF, *et al*. Antioxidant properties of prunes (*Prunus domestica* L.) and their constituents. Biofactors. 2004;21(1-4):309-313.
21. Bose M, Kamra M, Mullick R, Bhattacharya S, Das S, Karande AA, *et al*. Identification of a flavonoid isolated from plum (*Prunus domestica*) as a potent inhibitor of Hepatitis C virus entry. Scientific Reports. 2017;7:3965.
22. Ahmed T, Sadia H, Khalid A, Batool S, Janjua A. Report: Prunes and liver function: A clinical trial. Pakistan Journal of Pharmaceutical Sciences. 2010;23(4):463-466.
23. Jabeen Q, Aslam N, Akram A, Iqbal Z. Evaluation of prunes for hypotensive, angiotensin converting enzyme (ACE) inhibitory and diuretic activities in rats. Journal of Medicinal Plants Research. 2012;6(7):1361-1366.
24. Ahmed T, Shaheen A, Azam F, Safdar W. *Prunus domestica* alters functions of frog's heart. Pakistan Journal of Pharmaceutical Sciences. 2018;31(5):1817-1826.
25. Noratto GD, Garcia-Mazcorro JF, Markel M, *et al*. Carbohydrate-free peach (*Prunus persica*) and plum (*Prunus domestica*) juice affects fecal microbial ecology in an obese animal model. PLOS One, 2014, 9(7)
26. Roomi AB, Al-Salih RMH, Kredy HM. Study of polyphenolic extracts of *Prunus domestica* L. walnuts as hypolipidemic agents. International Journal of Current Microbiology and Applied Sciences. 2013;2(10):154-171.
27. Islam NU, Amin R, Shahid M, *et al*. A multi-target therapeutic potential of *Prunus domestica* gum stabilized nanoparticles exhibited prospective anticancer, antibacterial, urease-inhibition, anti-inflammatory and analgesic properties. BMC Complementary and Alternative Medicine. 2017;17(1):276.
28. Miljić U, Puškaš V, Velićanski A, *et al*. Chemical composition and *in vitro* antimicrobial and cytotoxic activities of plum (*Prunus domestica* L.) wine. Journal of the Institute of Brewing. 2016;122(2):342-349.
29. Dhingra N, Sharma R, Kar A. Antioxidative and antiproliferative activities of isolated compounds from *Prunus domestica*: an *in vitro* study. International Journal of Phytomedicine. 2013;5(3):341.
30. Noratto G, Porter W, Byrne D, Cisneros-Zevallos L. Identifying peach and plum polyphenols with chemopreventive potential against estrogen-independent breast cancer cells. Journal of Agricultural and Food Chemistry. 2009;57(12):5219-5226.
31. Bouayed J, Rammal H, Dicko A, Younos C, Soulimani R. Chlorogenic Acid, a polyphenol from *Prunus domestica* (Mirabelle), with coupled anxiolytic and antioxidant effects. Journal of the Neurological Sciences. 2007;262(1-2):77-84.
32. Piirainen L, Peuhkuri K, Bäckström K, Korpela R, Salminen S. Prune juice has a mild laxative effect in adults with certain gastrointestinal symptoms. Nutrition Research. 2007;27(8):511-513.
33. Ritchie J. Mass peristalsis in the human colon after contact with oxyphenisetin. Gut. 1972;13:211-219.
34. Saarinen U, Piirainen L, Nevala R, Korpela R. Yoghurt containing galacto-oligosaccharides, prunes and linseed reduces the severity of mild constipation in elderly subjects. European Journal of Clinical Nutrition. 2007;61:1423-1428.
35. Attaluri A, Donahoe R, Valestin J, Brown K, Rao SSC. Randomised clinical trial: Dried plums (prunes) vs. psyllium for constipation. Alimentary Pharmacology & Therapeutics. 2011;33:822-828.
36. Kosar S, Fatima I, Mahmood A, Ahmed R, Malik A, Talib S, *et al*. Purunusides A-C, α-glucosidase inhibitory homoisoflavone glucosides from *Prunus domestica*. Archives of Pharmacal Research. 2009;32:1705-1710.
37. Nayudu ST, Sowjanya K. Anti-Diabetic activity of methanolic extract of *Prunus domestica*. International Journal on Recent and Innovation Trends in Computing and Communication. 2017;5(4):213-220.
38. Houshmand H, Arjmandi BH. Dried plum, an emerging functional food that may effectively improve bone health. Ageing Research Reviews. 2009;8(2):122-127.
39. Arjmandi BH, Khalil DA, Lucas EA, Georgis A, Stoecker BJ, Hardin C, *et al*. Dried plums improve indices of bone formation in postmenopausal women. Journal of Women's Health & Gender-Based Medicine. 2002;11(1):61-68.
40. Deyhim F, Stoecker BJ, Brusewitz GH, Devareddy L, Arjmandi BH. Dried plum reverses bone loss in an osteopenic rat model of osteoporosis. Menopause. 2005;12(6):755-762.
41. Belhadj F, Marzouki MN. Antioxidant, antihemolytic and antibacterial effects of dried and fresh *Prunus domestica*. International Journal of Pharmaceutical Research and Bio-Science. 2014;3(6):191-207.
42. Yaqeen Z, Naqvi N, Sohail T, Zakir-ur R, Fatima N, Imran H, *et al*. Screening of solvent dependent antibacterial activity of *Prunus domestica*. Pakistan Journal of Pharmaceutical Sciences. 2013;26(2):409-414.
43. Shahidi S, Setareye S, Mahmoodi M. Effect of *Prunus domestica* L. (mirabelle) on learning and memory in mice. Ancient Science of Life. 2013;32(3):139-143.
44. Shukitt HB, Kalt W, Carey AN, Vinqvist-Tymchuk M, McDonald J, Joseph JA, *et al*. Plum juice, but not dried plum powder, is effective in mitigating cognitive deficits in aged rats. Nutrition. 2009;25:567-573.
45. Seniuk IV, Sahlanee BJA. Study of the anti-exudative activity of dry extract from *Prunus domestica* fruits. Ukrainian Biopharmaceutical Journal. 2019;2(59):55-59.
46. Hooshmand S, Kumar A, Zhang JY, Johnson SA, Chaid SC, Arjmandi BH, *et al*. Evidence for anti-inflammatory and antioxidative properties of dried plum polyphenols in macrophage RAW 264.7 cells. Food & Function. 2015;6(5):1719-1725.
47. Silvan JM, Michalska-Ciechanowska A, Martinez-Rodriguez AJ. Modulation of antibacterial, antioxidant,

and antiinflammatory properties by drying of *Prunus domestica* L. plum juice extracts. Microorganisms. 2020;8(1):119.
48. Karasawa K, Miyashita R, Otani H. Anti-allergic properties of a fruit extract of prune (*Prunus domestica* L.) in mite-sensitized BALB/c mice. Food Science and Technology Research. 2012;18(5):755-760.
49. Vetter J. Plant cyanogenic glycosides. Toxicon. 2000;38:11-36.