

Review

The insight and survey on medicinal properties and nutritive components of Shallot

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Shallot is a horticultural commodity belonging to spice vegetables. Shallot (*Allium ascalonicum* L.) is a perennial crop which is grown as an annual for its cluster of small cloves and bulbs. Persian shallot also is native and endemic of Iran and grows as a wild plant across Zagross mountains at high elevations. Shallot is an important source of carbohydrate, vitamin A, B, and C. Phenolic compound in Shallot consist of gallic acid, apigenin, eriodictyol, quercetin, isoquercetin, rutin, kaempferol, catechin and tannic acid. The most important health benefits of shallots are reduction of cancer risk, improve heart health, aid detoxification, help control diabetes, improve brain health, help to fight obesity and treat allergies, boost bone health, maintain vision health, boost immunity, improve skin health, increase abdominal health and keep hair healthy. The dominants medicinal properties of Persian shallot is it antibiotic, hypolipidemic, anticancer, antioxidant, hypoglycemic, kidney protective and hepatoprotective properties. This review article allowed verifying shallots as sources of compounds with valuable nutritional and bioactive properties with great ability for incorporation into foods with functional properties. Also, treatment with natural herbal medicine like shallot as non-synthetic drug is recommended.

Key words: Medicinal properties, nutritive components, shallot.

INTRODUCTION

Both natural products and traditional medicines have great importance (Shahrajabian et al., 2019a, b, c; Sun et al., 2019). Traditional medicine refers to health practices, knowledge, approaches and beliefs incorporating plants and herbs based on both ancient and modern pharmaceutical science (Ogbaji et al., 2018; Shahrajabian et al., 2019d,e). Traditional Asian medicine plays an important role in sustainable agriculture and food systems; it also offers a holistic and significant approach

to prevent diseases while making suitable usage of organic and herbal products (Soleymani and Shahrajabian, 2012; Ogbaji et al., 2013; Ge et al., 2018; Shahrajabian et al., 2018; Soleymani and Shahrajabian, 2018).

SHALLOT OCCURRENCE AND CULTIVATION

Shallot is one of the most important vegetable crops in

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various local cuisines in different part of the world (Sulistio et al., 2015; Yao et al., 2017; Tabor, 2018). Shallot (*Allium ascalonicum* L.) is a perennial crop which is grown as an annual for its cluster of small bulbs or cloves. Shallots are valuable spices for both flavoring dishes and as medicinal plants (Swamy and Veere Gowda, 2006). Greek history and literature mention shallots. It most likely originated in Southeast Asia and from there, spread into India and the Mediterranean region. Shallot is a hardy member of the onion family that is famous for its delicate, meaty, onion-like flavor. Persian shallot, a bulb producing plant from Alliaceae, is a wildly growing plant collected for its bulbs, and it is called Mooseer in Farsi, are oval, white skinned and completely different from common shallot (*Allium ascalonicum*) (Ebrahimi et al., 2019). Persian shallot is native and endemic of Iran and grows as a wild plant across Zagross mountains at high elevations of different provinces from Northwestern to Southern of Iran with the climate of very cold to moderate cold (Moradi et al., 2013). Shallot is a major component of many Asian diets and is widely believed to be beneficial to health (Jalal et al., 2011). Tesfa et al. (2015) found that shallot can be a substitute where bulb onion does not do well, however, the production of shallot can be limited due to poor soil fertility, lack of improved production techniques, unimproved varieties and high post-harvest losses. Shallots are a unique vegetable that is used by domestic consumers as every day seasoning, raw materials of food industry, and medicine (Sukasih, 2015). The most common diseases of shallots are downy mildew, bacterial soft rot and neck rot, and the most important insects are onion maggot and onion thrips.

CHEMICAL CONSTITUENTS AND HEALTH BENEFITS

Shallot is a source of carbohydrate, vitamin A, B, and C. Fasihzadeh et al. (2016) noted that 1-Butene,1-(methylthio)-(Z) (18.21%), methyl methylthiomethyl disulfide (8.41%), dimethyl tetrasulfide (6.47%), and piperitenone oxide (4.55%) are the most abundant components of Persian shallot and comprised 37% of the essential oil. Ebrahimi et al. (2008) showed that Iranian shallot landraces are important in mineral elements and essential fatty acids content and are recommended for human nutrition. Sittisart et al. (2017) showed that shallots extracts contained some polyphenols such as apigenin, gallic acid, catechin, quercetin, kaempferol and tannic acids which are famous compounds possessing antifungal activity. Golubkina et al. (2019) indicated that shallot is an excellent candidate for the health-centered strategy of producing functional foods with high levels of Se and antioxidants; and the usage of arbuscular mycorrhizal fungi and selenium application represent environmentally friendly strategies to enhance the overall yield and quality performances of shallot bulbs.

Fattorusso et al. (2002) reported two new furostanol saponins, named ascalonicoside A1/A2 (1a/1b) and ascalonicoside B(4), respectively, along with compounds 2a and 2b. Phaiphon et al. (2019) discovered that heating and shallot supplementation can massively improve the quality of apple juice. Yin et al. (2006) suggested the use of shallot and scallion oils in food systems which may enhance lipid and microbial stability. Raeisi et al. (2016) concluded that the application of 3% ajwain seed extract gave the best antioxidant and antimicrobial activities, as well as sensory, up to 15 days of storage, followed by 3% shallot fruit extract. Leelarungrayub et al. (2006) stated that organic solvent and aqueous extracts of garlic and shallot bulbs had significant antioxidant potential, as measured by decreases in free radicals and an ability to inhibit lipid oxidation. Wongmekiat et al. (2008) indicated the protective potential of shallot extract against CsA nephrotoxicity and suggest a significant contribution of its antioxidant property to this beneficial effect. Abdelrahman et al. (2017) provided evidence for the anticancer from shallot plants and a strong foundation for more investigations to build theoretical bases for cell apoptosis and development of novel anticancer drugs. Seyfi et al. (2010) proved that shallot is a useful herb with therapeutic or preventive activity against angiogenesis related disorders. Chen et al. (2011) have shown the potential of shallots for use in treating adenoviral infection activities. Krejčova et al. (2014) found the usage of Persian shallot for the treatment of inflammatory disorders. They introduced 2-[(Methylthio)methyl]dithio]pyridine *N*-oxide with high anti-inflammatory effects. Hajian et al. (2018) showed that shallot extract can dose dependently reduce the factors related to lead induced renal damages. Falahati et al. (2011) indicated that crude juice of shallot has anti-candidal activity and might be promising in the treatment of candidiasis. Kongkaew and Phichai (2010) found that dried shallot powder, was effective at inhibiting the growth of *Trichoderma* spp. isolated from Yanagi mushroom. Noengpa (2004) mentioned that water extract of shallot showed inhibitory effects on *C. gloeosporioides* and *Fusarium* sp. spore growth. Amin et al. (2009) noticed that based on the antimicrobial compounds, shallot can be effective medicine for treatment of dermatomycosis and other infectious diseases. Jalal et al. (2011) found that Iranian shallot extracts appear to improve learning and memory impairments in fructose-fed rats. Mohammadi-Motlagh et al. (2011) indicated that shallot can be a candidate for prevention and treatment of many diseases related to inflammation and malignancy. Leelarungrayub et al. (2004) indicated that hexane-extract shallot had very high activity on protecting the human erythrocyte from radicals and is possible to be modified for medical plants or commercial product in the future. Sadat Hosseini et al. (2017) found that the Persian shallot extract could be considered as a potential candidate for production of drug for the prevention or treatment of human hepatoma.

Table 1. Contents of polyphenols in extracts of chili, shallot and garlic (Sisaket varieties) (Sittisart et al, 2017).

Phenolic compound	Plant extract (mg/mL)		
	Chili	Shallot	Garlic
Gallic acid	32.77	2.13	3.14
Eriodictyol	-	0.37	-
Apigenin	11.49	0.11	0.32
Isoquercetin	2.82	10.55	0.33
Kaempferol	-	0.66	-
Quercetin	-	35.91	-
Rutin	3.22	-	-
Catechin	8.50	-	6.93
Tannic acid	66.33	21.71	13.18

Table 2. Some components found in Persian shallot (Moradi et al., 2013).

S/N	Component
1	Allicin
2	Saponins
3	Sapogenins
4	Ajoene
5	Sulphuric compounds (thiosulfinates)
6	Flavonoids: Quercetin and Kaempferol
7	Mineral Elements
8	Essential fatty acids
9	Folic acid
10	Protein
11	Fiber
13	Vitamin C

Iranian shallot extracts appear to improve learning and memory impairments in fructose-fed rats (Razieh et al., 2011). Amanzadeh et al. (2006) proved the inhibitory effect of Persian shallot hydroalcoholic extract on *Leishmania infantum*. Nasiri Kashani et al. (2009) indicated that shallot crude juice has antifungal activity and looks promising to be an alternative for chemical antifungal agents that have sometimes serious effects. Rattanachaikunsopon and Phumkhachorn (2009) reported that shallot oil inhibit pathogenic bacteria including *Bacillus cereus*, *Campylobacter jejuni*, *Escherichia coli* O 157:H7, *Listeria monocytogenes*, *Salmonella enterica*, *Staphylococcus aureus*, and *Vibrio Cholerae*. Farajii et al. (2018) stated that the shallot extract was preferred in both terms of reducing microbial growth and suitable sensory properties. Zarei Mahmoodabadi and Gharib Nasery (2009) concluded that the fresh crude juice of shallot bulbs has markedly antifungal effect, and also shallot extract has more anti-saprophytes effect at 0.25% followed by *C. albicans* and

dermatophytes.

Kazemian et al. (2017) noted that hydroalcoholic shallot extract increases the number of germ cells in mice tested and helps amplify the sexual ability of male mice. Shallot as traditional medicine are for febrifuge, diabetes, blood sugar and blood cholesterol, and also prevents thickening and hardening of the blood vessels and ulcers (Sukasih, 2015). Sukasih (2015) also reported that shallot powder is widely used as an industrial raw material such as in snacks production, seasoning in cooking, and medicine. Persian shallot has been reported to have a range of health benefits which include anticarcinogenic, hypoglycemic, hypolipidemic, antioxidant, antibiotic properties, and kidney and liver protective effects (Moradi et al., 2013). Contents of polyphenols in extract of chili, shallot and garlic are shown in Table 1. Some components found in Persian shallot are presented in Table 2. Medicinal properties of in Table 3. Volatile organic compounds in shallot with absorption on SPME fiber at 20°C are presented in Table 4.

Table 3. Medicinal properties of Persian shallot (Moradi et al., 2013).

S/N	Properties
1	Antibiotic properties
2	Hypolipidemic properties
3	Anticancer properties
4	Antioxidant properties
5	Hypoglycemic properties
6	Kidney protective properties
7	Hepatoprotective properties

Table 4. Volatile organic compounds in shallot with absorption on SPME fiber at 20°C (DAuria and Racioppi, 2017).

Compound	r.t. (min)	KI	Area (%)
Methanethiol	1.61	500	0.46±0.01
Propanethiol	2.30	600	4.20±0.02
Thiopropanal S-oxide	4.37	740	
2-Methyl-2-pentenal	5.66	804	0.13±0.01
2,5-Dimethylthiophene	7.18	865	1.06±0.01
Methylisopropylsulphide	7.78	880	2.74±0.02
Dipropylsulphide	11.64	1094	58.57±0.05
Allypropylsulphide	11.82	1098	13.27±0.05
Methyl propylthiosulphonate	12.35	1154	0.46±0.02
Dipropyltrisulphide	15.52	1294	6.99±0.03
Allypropyltrisulfide	15.74	1309	0.83±0.01

Table 5. Volatile organic compounds in shallot with absorption on SPME fiber at 50°C (DAuria and Racioppi, 2017).

Compound	r.t. (min)	Area (%)
Propanethiol	2.31	2.57±0.01
2-Methyl-2-pentenal	5.65	0.20±0.01
2,5-Dimethylthiophene	7.18	0.51±0.01
Methylpropylsulphide	7.77	1.42±0.03
Dipropylsulphide	11.62	34.80±0.05
Allypropylsulphide	11.79	7.14±0.03
Methylpropylthiosulfonate	12.36	1.72±0.02
Dipropyltrisulphide	15.66	21.70±0.05
Allypropyltrisulphide	15.82	9.18±0.03
Compound 4	19.41	4.35±0.03
Compound 5	19.64	2.00±0.02
Compound 6	19.80	3.72±0.02
Compound 7	22.51	2.02±0.02

Volatile organic compounds in shallot with absorption on SPME fiber at 50°C are presented in Table 5. The most important health benefits of shallots are shown in Table 6.

Conclusion

Shallot is a key part of diet of many populations and there is long-held belief in their health enhancing properties.

Table 6. The most important health benefits of shallots.

S/N	Benefit
1	Reduction of cancer risk
2	Improve heart health
3	Aid detoxification
4	Help control diabetes
5	Improve brain health
6	Help fight obesity
7	Help treat allergies
8	Boost bone health
9	Might maintain vision health
10	Boost immunity
11	Improve skin health
13	Enhance abdominal health
14	Keep Hair healthy

Historically, the shallot has been used for both its nutritional and aromatic properties in Iranian, Indian, Chinese, Asian, French and Mediterranean cooking. The shallot is considered an important plant in Asian medicinal practices and is commonly prescribed as an effective remedy for various ailments in Ayurvedic medicine. Shallots, like onions, are a member of the allium family, but their flavor is richer, sweeter, yet more potent. The most important benefits of shallots are high source of antioxidants, improve heart health, cancer prevention, diabetes, anti-inflammatory, antimicrobial, might help fight obesity, and help to prevent or treat allergies. The demand for shallot products is increasing every year with increase population growth and food industries. More clinical studies may be required to uncover the numerous substances and their effects in shallot that contribute to public health.

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CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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