



## The effects of nutritional and medicinal mastic herb (*Pistacia atlantica*)

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### ABSTRACT

A wide variety of medicinal plants are used as pharmaceutical agents in the treatment of diseases, in Iran. One type of these plants is the mastic. The Genus of mastic is *Pistacia* and its family is Anacardiaceae. This genus has eleven species, some of them in Asia and the Mediterranean area, have many medical, social and economic importance. The main aim this study we review to present the new achievements in medical, social and economic uses of mastic. The results showed that *N. sativa* has many therapeutic effects such as antioxidant Activity, analgesic, anti-inflammatory, antimicrobial, anticancer, antidiabetic, anticholinesterase, so it can be used as a valuable plant for producing of drugs in treatment of so many disorders and diseases.

**Keywords:** Medicinal plants, Mastic, *Pistacia atlantica*, Iran

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### INTRODUCTION

Medicinal plants have a long history of usage, especially in the treatment of various diseases<sup>[1]</sup>. Recent studies have also scientifically confirmed their effects in prevention<sup>[1][2]</sup> and treatment<sup>[3][4]</sup> of a wide variety of diseases such as cancer<sup>[5][6]</sup>, cardiovascular<sup>[7][8]</sup>, diabetes<sup>[9][10]</sup>, hypertension<sup>[11][12]</sup> and atherosclerosis<sup>[13]</sup> diseases. They are also able to diminish the adverse effects of other drugs<sup>[14][15]</sup> and even heavy counteract with metal or other toxins<sup>[16][17]</sup>. Medicinal plants have been shown to possess the advantage of having low side effects, too<sup>[18][19]</sup>. Hence, other than uses in industry, they are also considered as reliable sources for new drugs. Iran due to the specific climatic conditions is one of the richest sources of medicinal plants. A wide variety of medicinal plants are used as pharmaceutical agents in the treatment of diseases, in Iran<sup>[20-22]</sup>.

One of these plants is the mastic. The Genus of mastic is *Pistacia* and its family is Anacardiaceae. This genus has eleven species, some of them in Asia and the Mediterranean area, have many medical, social and economic importance<sup>[23]</sup>.

In this review we tried to present the new achievements in medical, social and economic uses of mastic.

**Plant description**

Mastic is a tree with a height of 2 to 7 m and usually grows in the mountains and in autumn becomes beautiful orange. This tree has one shoulder leaf and 5 to 7 inflorescences leaflets that are in variety of species have different forms. This plant is single sex and has 5 sepals and no petals. The male flowers have 4-5 flag folds and female flowers have a short style. Branches of the tree are grayish-white (Figure 1) <sup>[24] [25]</sup>.



Figure 1: Mastic plant

The plant characteristics and morphological information is given in Table 1.

Table 1: The herbal characteristics and morphological information about mastic plant

Life form:	Phanerophyte, tree
Stems:	Up to 7 m; stout trunk, covered in fissured bark; branches often have galls; drought-tolerant tree, with an extensive root system
Leaves:	Alternate, compound, pinnate; leaves often have galls
Flowers:	Unisexual; pink; flowering occurs before vegetative development, and males tend to flower before females (protandry). Females and males invest more energy in reproduction (that is, seed and fruits) and in flowering early before leaf production
Fruits / pods:	Oblong, fleshy, oily fruit borne by the female tree; 6 to 8 mm long, pink, ripening blue
Flowering Period:	February, March, April
Habitat:	Mediterranean maquis and forest, Hard rock outcrops
Distribution:	Mediterranean Woodlands and Shrublands, Semi-steppe shrublands, Shrub-steppes, Deserts and extreme deserts
Chorotype:	Irano-Turanian
Summer shedding:	Perenating

The scientific classification of mastic is shown in Table 2.

Table 2. Scientific classification of mastic

<b><i>Pistacia atlantica</i> Desf.</b>	
<b>Scientific classification</b>	
Kingdom:	Plantae
Order:	Sapindales
Family:	Anacardiaceae
Genus:	<i>Pistacia</i>
Species:	<i>P. atlantica</i>

In Persian this plant is called Baneh, in English Atlas mastic tree, in Arabic language is called Butm or Butum, in Turkish Melengic, and in Canary Islands is called Almagigo. Other names of it are: Chatlanqus, Kabul Chatlanqus, turpentine. Vanoshak is the mastic tree fruit that in some areas is known as mountain pistachio (figure3).

Vanoshak has a green thin wrapper and also has a somewhat stiff shell which its marrow is usable. This product is only used by citizens of Ilam province and territory of "people inhabited in Zagros, Iran". Elamite older people believe that taking this natural fruit that is found abundantly in this season of the year in the mountainous province has great properties for removing stomach illness. Vanoshak is more popular among the youth because of its unique taste. Mastic (Baneh) is a herbal seed with delicious marrow that is used as farming seed, but it has a hard shell that is harmful for teeth. This seed usually grows in autumn. Mastic grows in Ilam, Kordestan and Kohgiluyeh-Boer-Ahmad provinces.



Figure 2. Mastic fruit (Vanoshak)

The secreted gum from this tree is called turpentine or condor and is used in gum (4-6) (figure 3)



Figure 3: Condor

Scabies is a change in the shape of leaves or twigs of mastic tree and have adhesive and tannin materials that can be used in medical and industrial uses. These scabies are collected in late summer or early fall before autumn rains beginning and immediately make them dried which would be ready for use. There is a leachate in the inner tissues of the mastic tree, which in summer is normally removed from the pores of the bark that is known as Mastaki. This yellow leachate in summer is gotten out from the stems and branches of the mastic tree in form of droplets and after shedding it under the tree after and exposed to air is hardened. The use of turpentine sap is in the preparation of gum and also in perfumes, fragrant, insecticides and pharmaceutical industries in producing of teners and antiseptics. In addition, it is used in plastics industry, polymeric industry, Locke industry, and as an emulsifier in oil printing-producing and oil-cable, in making parquet and flooring, dressings, papers and also as fungicide to protect wood, paper and cloth. This turpentine sap is also used in preparation of shoe and leather wax and printing industry.

### Phytochemical compositions

Various phytochemical compounds have been identified in *Pistacia* species. The most important of them, focusing on *Pistacia atlantica* are summarized bellow: Essential oil is one of the main components of *Pistacia* species which is from various parts of plant including ripe and unripe fruits, leaf-buds, twigs, flowers leaves, resin, and galls. Analysis of essential oils has been shown many qualitative and quantitative differences in the content of essential oils obtained from various parts of the plant. The differences are related to parameters such as plant species and part, harvesting time, climatic conditions, geographical origin, and sex of cultivars,<sup>[26][27]</sup>. Oxygenated monoterpenes and hydrocarbon are the main constituents in essential oil.  $\alpha$ -Pinene is the main compound of hydrocarbon monoterpenes, which is seen in some specimens such as *P. atlantica*<sup>[28]</sup>. Other major components which have been isolated from various parts of *Pistacia* species include: limonene,  $\alpha$ -terpinolene, limonene and (*E*)- $\beta$ -Ocimene, terpinen-4-ol, (*E*)- $\beta$ -Ocimene, *p*-cymen, and the shoots of *P. terebinthus*<sup>[29-31]</sup>; bornyl acetate, terpinen-4-ol, sabinene, and myrcene from the fruits, myrcene, *p*-mentha-1 (7),8 diene, terpinen-4-ol, and ocimene from the leaves<sup>[28][30-32]</sup>, *p*-mentha-1 (7),8 diene and sabinene from the leaf buds, and  $\Delta^3$ -carene from galls of *P. atlantica*<sup>[32]</sup>. **Triterpenoids.** Triterpenes such as oleanolic acid, ursonic acid, masticadienonic acid, masticadienolic acid, and morolic acid have been detected in *P. atlantica* resins<sup>[33]</sup>. Masticadienolic acid, morolic acid, and masticadienonic acid have anti-inflammatory properties<sup>[34]</sup>. **Phenolic Compounds.** Catechin, epicatechin, and Gallic acid, with antioxidant activity have been detected in galls of *P. atlantica*<sup>[35]</sup>. Flavonoid compounds with antioxidant activity are also present in different parts of these species, including aerial parts of *P. atlantica*<sup>[36]</sup>. A flavone with anti-plasmodial activity (3-Methoxycarpachromene), has been isolated from aerial parts of *P. atlantica*<sup>[37]</sup>. The oil content of *P. vera* kernel is about 50–60%<sup>[38]</sup> and in ripe fruits of *P. atlantica* is about 32.8–45%<sup>[39]</sup>. Oleic acid is the most abundant fatty acid in oil of *P. atlantica*<sup>[67]</sup>. Other fatty acids identified in this plant are stearic, myristic, eicosanoic, linolenic, palmitic, lignoceric, arachidonic, palmitoleic, behenic, pentadecanoic, margaric acid, hexadecanoic and octadecanoic<sup>[38][40]</sup>. The main sterol in fruits of *P. atlantica*, is sitosterol<sup>[41]</sup>. The oil from fruits of *P. atlantica*, other than having desirable odor and taste, is recommended for production of vegetable oils with high amount of omega-3 fatty acids like linolenic acid and oleic acid<sup>[41]</sup>. Tocopherols and tocotrienols are also abundantly found in *P. atlantica* hull oil<sup>[42]</sup>.

### Pharmacological aspects and therapeutic Uses

**Antioxidant Activity.** Various parts as well as constituents from *P. atlantica* fruits and leaves have antioxidant activities significantly higher than those of standard antioxidants<sup>[43][44]</sup>. **4.2. Antimutagenic Activity.** Essential oil and different extracts from *P. lentiscus* leaves indicated significant inhibitory effect on mutagenicity in vitro [45, 46]. Gallic acid, digallic acid, and 1,2,3,4,6-pentagalloylglucose, polyphenols isolated from the fruits of *P. lentiscus*, induced an inhibitory activity against mutagenicity and genotoxicity in in vitro assays<sup>[47]</sup>. **Antimicrobial Activities.** Most of *Pistacia* species have been shown to possess significant antibacterial properties against a wide variety of Gram positive and Gram negative bacteria. Antimicrobial activity of the gum from *P. atlantica* var. *kurdica* and some of its major constituents such as  $\alpha$ -pinene and *P. vera* gum has been shown to be significant against *Helicobacter pylori*<sup>[8][21]</sup>. The essential oil from gum and leaves of *P. atlantica* revealed significant antifungal and antibacterial activities<sup>[46][48-49]</sup>. The twigs and leaves of *P. atlantica* and one of its component 3-methoxycarpachromene showed inhibitory activity against *Salmonella typhimurium*, *S. enteritidis* and *Staphylococcus aureus*<sup>[45]</sup>. *P. atlantica* var. *kurdica* gum has been shown to control cutaneous leishmaniasis in mice which was infected with *Leishmania major*<sup>[50]</sup>. **Analgesic and Anti-Inflammatory Activities.** Antinociception and anti-inflammatory activities of some *Pistacia* species have been revealed in different acute and chronic inflammatory models. However, these effects have not been examined for *P. atlantica*<sup>[51]</sup>. **Antidiabetic Activity.** In vitro study has shown that the leaf extract of *P. atlantica* inhibits  $\alpha$ -glucosidase and  $\alpha$ -amylase<sup>[109][52]</sup>. It has

also shown postprandial antihyperglycemic activity equal to glipizide and metformin in rats and improved glucose intolerance<sup>[52]</sup>. *Anticancer effect*: The fruit extract of *P. atlantica* sub. *kurdica* has revealed inhibitory activity on human colon carcinoma cells the same as Doxorubicin<sup>[53]</sup>. *Anticholinesterase Activity*. The extracts of *P. atlantica* leaves has strong acetyl-cholinesterase inhibitory activity<sup>[6]</sup>. In Iranian traditional medicine it has been mentioned that eating mastic fruits is beneficial in strengthening sex drive. Mastic fruit has diuretic effect and stimulates menstrual period. For treatment of simple diarrhea, the skin and leaves of this plant can be used. Mastic can be used to relieve anemia. Usually in the local foods such as curd, mastic is used instead of walnuts. For back pain and joint pain we can rub the oil of this plant on lower back. To purify the liver and to remove headache the pickling mastic can be used. The burnt poultice of mastic is used for grow hair. This poultice is also suitable for Gary disease. For people eating too much mastic is harmful for hot-natured persons. Mastic oil can be used to smooth out the sound. To strengthening mental health, beaten the mastic and mixed with sugar and eat. Eating mastic fruit halva can be bolstered. For kidney and disposal of its small stones the mastic can be used. Mastic oil and the fruit is the cleaner of sputum of throat and lung. In order to improve the paralysis and leghve disease, eat a bit of mastic oil and massage the member with it. Also the tree bark can be boil with mastic and then eat. Eating mastic oil is useful for treating jaundice. Those who have difficulty in urine excretion, consumption of mastic oil is useful. The amount of mastic oil that can be eaten is about 10 grams. Those who want to be obese, should press mastic, peanuts, treenuts and eat with sugar. To clear the skin of the face, mastic should be pressed and put on the face as mask. To eliminate the birth mark, the mastic should be pressed and put it on the birthmark and continue until the birthmarks go away. Eating mastic prevents the cracking of lips. Mastic is useful for the treatment of night blindness. The gum of this tree has turpentine and its chewing is stomach tonic and helps in digestion and also is diuretic. For the treatment of tilt and bursting nail, you should heat the gum with fat then put it on nail as poultice. The poultice can be used to treat anal fissure. To treat swelling, itching and cracking of the skin, this gum can be mixed with olive oil and rubbed on skin. Those who have rickets can use mastic. To dislodge insects incense its leaves. To grow and maintain long hair, mix the leaves crushed with a little vinegar and mastic oil and rub on hair. Different parts of this plant are used for therapeutic and medicinal and edible cases.

## DISCUSSION

In traditional medicine of Iran, *P. atlantica*, has been introduced for treating the wide variety of diseases. It is now utilized for different medicinal and nutritional proposes. This review presented the findings about pharmacological, traditional and phytochemical properties of *P. atlantica* and also presented comprehensive analysis of this plant derived data from literature. Medicinal plants play an important role in the health of human and communities<sup>[7-8][12]</sup>. The medicinal value of these plants is dependent on the chemical compounds of them that cause certain physiological functions in the human body. The most important of these components are: alkaloids, tannins, flavonoids and phenolic compounds<sup>[54]</sup>.

Medicinal plants due to their secondary materials are good source for treatment for diabetes mellitus<sup>[55]</sup>, and migraine headaches<sup>[56]</sup>, parasitic disorders<sup>[1][57-58]</sup>, anxiety, stress and nervous<sup>[58-61]</sup>, respiratory<sup>[62]</sup>, toothache<sup>[63]</sup>, wound healing<sup>[64]</sup>, etc., but also has good effects in the treatment of hyperlipidemia and lipid-induced diseases related to it.

Most of components of wild pistachio, especially the kernel oil, have made it as a source of natural antioxidants<sup>[65]</sup><sup>[66]</sup>. Although there are various compounds with different actions in this plant, however, this plant possesses high level of antioxidants which are capable of counteracting free radicals induced oxidative stress. High level of oxidative stress has been shown to induce a wide variety of diseases such as atherosclerosis<sup>[67]</sup>, diabetes mellitus<sup>[68]</sup><sup>[69]</sup>, tissue injury<sup>[70][71]</sup>, infectious<sup>[72][73]</sup> and gastrointestinal<sup>[55][74,75]</sup> diseases. A lot of drugs and toxins also cause oxidative stress<sup>[3][76]</sup>. Plant with high level of antioxidants have also been shown to be capable of ameliorating these conditions<sup>[68][77,78]</sup>. Therefore, *P. atlantica* which has high level of antioxidant activity might be beneficial in prevention or treatment of oxidative stress induced diseases. In this review, we reported some of pharmaceutical effects of *Pistacia atlantica* as an ancient and new Iranian herbal medicine. In conclusion, *Pistacia atlantica* seems to be useful as the herb that has various pharmacologic effects. Therefore, more preclinical and clinical studies are recommended to more elucidate its beneficial and risk effects in different conditions.

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