

Adiantum capillus-veneris and Respiratory Diseases

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Abstract

Adiantum capillus-veneris L. (Pare-siavashan) is a plant from the Pteridaceae family with many uses in traditional and folk medicine. This plant grows in different parts of the world. According to the references of Persian medicine, it has many positive effects on the digestive system, urogenital system, integumentary system, eyes, spleen, edema, and respiratory system (e.g., dyspnea). It is used in folk medicine in parts of the world to cure menstrual disorders, cold, cough, abdominal pain, fever, headache, bronchitis, hair loss, and diabetes.

Contemporary researchers have proven the antioxidant, antimicrobial, and anti-inflammatory effects of this plant. The clinical studies conducted on the effects of this plant on respiratory diseases are few and more research is necessary. According to the properties mentioned for this plant, its use in the treatment of asthma and inflammatory diseases of the respiratory tract and its infections can be considered.

Keywords: Persian medicine, Pare-siavashan, *Adiantum capillus-veneris*, Asthma, Dyspnea, Respiratory system

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Introduction

Respiratory diseases are the main causes of disease burden and mortality in the world.¹ On average, 34 deaths due to respiratory diseases occurred in Iran per 100 000 people in 2011. A 36% increase in this rate was observed in 2018 compared to 2011.² The respiratory system plays an essential role in human health, and lung involvement in the inflammatory processes, infectious diseases, and cancers is one of the important concerns of physicians and researchers in the health field.

Despite significant advances in the production of synthetic drugs in the 20th century, more than 25% of approved drugs in industrialized countries are produced directly or indirectly from plants. Medicinal plants have great potential in the treatment of chronic and infectious diseases and have fewer side effects than synthetic drugs. Therefore, they may be a suitable alternative to chemical drugs in dealing with pathogenic microorganisms.³

The increasing tendency of societies towards traditional medicine and the use of medicinal plants has convinced the World Health Organization (WHO) to plan for the use of this medicine. To ensure the efficiency and safety

of traditional medicine, the WHO believes in supporting the research of traditional medicine centers and the institutionalization of evidence-based medicine (EBM) in this medicine.⁴ In recent years, for more effective treatment of inflammatory and infectious diseases, researchers have studied the active ingredients in medicinal plants.

Adiantum capillus-veneris (Pare-siavashan in Persian, Maidenhair fern in English), a plant of the Pteridaceae family, was described by Discoridus around 100 AD. It is one of the most commonly used plants of this family for medicinal and food purposes.⁵ It is considered one of the most effective plants in the treatment of respiratory diseases.⁶ All the parts of Pare-siavashan are used medicinally⁷ and in traditional medicine, this plant has many therapeutic applications, including the treatment of some respiratory diseases.⁸⁻¹¹ The purpose of this review article is to investigate the role of Pare-siavashan in the treatment of respiratory tract diseases.

Materials and Methods

In this review study, which has been done in 2022, the words Pare-siavashan, Barsiavoshan, Kuzburat-el bir,



Shaar-ul-jin, Shaar-ul-jibal, Sagh-ul-Asvad were searched in some of the main books of Persian medicine¹²⁻¹⁴ including Makhzan-ol-Advieh, Samil fi as-Sina A at-Tibbiyya, Al-Qanoon fi teb, Taghvim-ol-Advieh, and Teb-e-Akbari and their uses in traditional medicine were extracted.

Then, the words *Adiantum capillus-veneris*, Pare-siavashan, Maidenhair fern, respiratory system, dyspnea, and asthma were searched in the Google Scholar, Science Direct, PubMed, and SID databases, and the related data were reviewed.

Results

Pare-siavashan

The scientific name of this plant is *Adiantum capillus-veneris*, and in Arabic, it is called Kuzburat-el bir, Shaar-ul-jin, Shaar-ul-jibal, and Sagh-ul-Asvad. This plant belongs to the Adiantaceae family.^{8,15} It is called Avenca in Brazil, maidenhair fern in England, and Hansraj in India.¹⁶ The scientific classification of Pare-siavashan can be seen in Table 1.¹⁷

This plant is found in the Indian subcontinent, Mexico, the Western Himalayas, warmer regions of America (central and southern), Southern Europe, the Atlantic coast of Ireland, Australia, Iran, and other tropical and subtropical regions of the world.^{18,19} More than 130 compounds belonging to triterpenoids, flavonoids, phenylpropanoids, phenolics, coumarins, phytosterols, and fatty acids have been identified in this plant. Triterpenoids and flavonoids are the main compounds identified in *A. capillus-veneris*.²⁰ Due to its antioxidant properties,²¹ this plant can be used as a strong and low-risk natural medicine to treat and reduce the symptoms of many diseases.²² The antioxidant properties of plant extracts are mainly related to phytochemicals (such as phenol/polyphenols, vitamins, and flavonoids) that can inhibit the oxidation process in the body by increasing the activity of antioxidant enzymes (such as catalase and superoxide dismutase).²³ The flavonoids in the plant have high inhibitory activity on hydroxyl radicals.²⁴ Some flavonoids, such as quercetin and gallic acid, are present in large quantities in the methanolic extract of Pare-siavashan.²⁵ Researchers believe that quercetin has anti-cancer effects.²⁶ *A. capillus-veneris* ethanolic extract plays a role in regulating the activity of the thyroid gland, and by increasing the level of T3 and T4, it can help treat propylthiouracil-induced hypothyroidism.²⁰ In another study, the effect of Pare-siavashan alcoholic extract on propylthiouracil-induced hypothyroidism in Wistar rats was investigated, and it was found that the consumption of this extract increased the serum levels of TPO, T3,

and T4 and decreased TSH.²⁵ Moreover, Pare-siavashan has minerals including arsenic, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, phosphorus, potassium, selenium, sodium, sulfur, tin, vanadium, and zinc.²⁵

Pare-siavashan in Folk Medicine

This plant is used in the folk medicine of some nations to treat several diseases, some of which are mentioned below.

It is used to control headaches and colds in tribes of South Africa, along with pepper to reduce fever in Punjab, along with honey to treat pharyngeal secretions in southern India, to relieve abdominal colic and amenorrhea in some areas of Mexico, and to relieve cough in most European regions due to mucilaginous, pectoral, and expectorant properties.²⁰

Additionally, this plant is used in Europe and England for the treatment of asthma, cough, bronchitis, dandruff, hair loss, jaundice, kidney stones, menstrual disorders, edema, pleurisy, alcoholism, diabetes, and influenza. In America, it has been used to improve cough, fever, chills, influenza, respiratory problems, and menstrual disorders.²⁷

Pare-siavashan in Persian Medicine

In Persian medicine, Pare-siavashan has a moderate (slightly hot and dry) temperament. It has many effects on the digestive system (control of diarrhea, bile, phlegm, and soda), respiratory system (treatment of lung diseases, asthma, shortness of breath, chest pain, and colds), genitourinary system (expulsion of stones and facilitation of urination, the flow of menstruation, and removal of the choroid), skin and hair disorders (treatment of wounds and baldness), and edema.^{8,9,24} Table 2 introduces the above-mentioned three terms belonging to Persian medicine (bile, phlegm, and soda).

It is suggested that it should not be used during pregnancy due to stimulation of menstruation and placental discharge before childbirth.

Inal-Qanun Fial-Tibb, Alabniye-Anhaghayegholadviye, Tadzkirah oli al-Albab va al-Jame lel-Ajab al-Ajaeb, Tohfa Al-Momenin, and Makhzan Al-adwiyah, this plant is suggested for the treatment of hair disorders.²⁸ This plant has been reported to be harmful to the spleen, but Mastic can ameliorate its harmful effect.^{8,9} Pare-siavashan is known as one of the widely used herbal antioxidants in traditional Chinese medicine.²⁹

Pare-siavashan in Allopathic Medicine

This plant was the main component of anti-cough syrup called capillaire, which was used until the 19th century.³⁰

Table 1. Taxonomic Classification of Pare-siavashan

Kingdom	Sub-Kingdom	Division	Class	Order	Family	Genus
Plantae	Traciobionta	Pteridophyta	Filicopsida	Polypodiales	Pteridaceae	Adiantum L.

In 2018, in a review study, Dehdari and Hajimehdipoor investigated the effects of Pare-siavashan according to new scientific findings and found many properties for this plant, which are shown in Table 3.³¹ These findings have been confirmed in other studies.^{24,32}

Although the burden of infectious diseases has decreased compared to the past, infectious diseases are currently among the health challenges, especially in developing countries. Due to the increase in bacterial resistance to antibiotics, finding alternative drugs is one of the serious challenges in the treatment and control of infectious diseases. Studies have shown that Pare-siavashan is a natural source of antimicrobial compounds.³⁹

The antimicrobial and some other effects of Pare-siavashan are presented in Table 3 in detail.

Moreover, it is notable that Pare-siavashan is contraindicated in pregnant women because it has an anti-implantation effect.¹⁷

Respiratory Diseases and Pare-siavashan

Asthma is a chronic inflammatory disease of the respiratory

system and manifests itself with signs and symptoms such as coughing, wheezing, shortness of breath, chest pain, or chest tightness. In this disease, the number of eosinophils, mast cells and basophils increases in the lung. These cells produce cytokines and inflammatory mediators such as histamine and leukotrienes and finally lead to the entry of water into the cells and the mucosal edema of their constricted airways.⁴⁰

In reference books of Iranian traditional medicine, the word asthma is not used; however, some researchers consider the word “rabv” to be equivalent to asthma.⁴¹ In another study, possible diseases synonymous with asthma have been mentioned with the names of “Zigh-o-nafas, E ntesab-o-nafas, rebv, and bohr.”⁴² In a study by Soltani et al, asthma is equivalent to bronchial asthma, and in addition to explaining the causes of shortness of breath from the perspective of Iranian medical scientists, they have provided specific treatments recommended for each. On this basis, Razi (known as Rhazes in Latin) described for the first time the role of lung edema in causing abnormal breathing and identified the presence of thick sticky mucus in the bronchioles as the cause of asthma, which prevents air from reaching the air sacs. Avicenna has also supported this theory and mentioned wheezing and long exhalation.⁴³

More than 122 plants and some mineral and animal substances have been used the treatment of breathing disorders in Iranian medicine. These plants can be

Table 2. Definition of Bile, Phlegm, and Soda, Three Main Bases of Persian Medicine

Term	Definition
Bile	Hot and dry in quality, dominant upon the kidneys
Phlegm	Cold and moist in quality, dominant upon the chest
Soda	Cold and dry in quality, dominant upon the abdomen

Table 3. Pare-siavashan in Allopathic Medicine

Topic	Authors	Year	Effects of Pare-siavashan
Medicinal properties of <i>Adiantum capillus-veneris</i> Linn. in traditional medicine and modern phytotherapy: a review article	Dehdari and Hajimehdipoor ³¹	2018	The plant exhibited antidiabetic, anti-thyroidal, antibacterial, anticonvulsant, analgesic, hypocholesterolemic, anti-fungal, wound healing, anti-obesity, anti-hair loss, anti-asthmatic, anti-inflammatory, anti-diarrheal, anti-spasmodic, detoxifying, and anti-urolithiatic effects.
Studying the inhibitory effect of Parsiavashan extract on gram-positive and gram-negative bacteria	Amin et al ³³	2011	The flavonoids in the methanolic extract of this plant had good antibacterial effects on <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , and <i>Helicobacter pylori</i> . It also had protective effects on the digestive system.
In vitro phytochemical, antibacterial, and antifungal activities of leaf, stem, and root extracts of <i>Adiantum capillus veneris</i> .	Ishaq et al ¹⁹	2014	Aqueous and alcoholic extracts of Pare-siavashan had antimicrobial effects on resistant microorganisms.
<i>Adiantum capillus-veneris</i> L.: phytochemical constituents, traditional uses and pharmacological properties: a review	Ansari et al ²⁷	2012	The ethanolic extract of this plant had antiviral effects against the vesicular stomatitis virus.
Antimicrobial activity and spectral chemical analysis of methanolic leaves extract of <i>Adiantum capillus-veneris</i> using GC-MS and FT-IR spectroscopy	Hussein et al ³⁴	2016	Antimicrobial effects of the ethanolic extract of Pare-siavashan leaves on <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus aureus</i> , <i>Salmonella typhi</i> , <i>Bacillus subtilis</i> , <i>Streptococcus faecalis</i> , and species of <i>Aspergillus fungi</i> were observed.
Antibacterial potential of antimicrobial peptides containing whole proteins of two <i>Adiantum</i> species from Himalaya against selected human bacterial pathogens.	Negi et al ³⁵	2020	Antimicrobial peptides in Pare-siavashan had antimicrobial effects comparable to amoxicillin and erythromycin against <i>Escherichia coli</i> , <i>Klebsiella pneumoniae</i> , <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus aureus</i> , <i>Streptococcus pneumoniae</i> , and <i>Streptococcus faecalis</i> .
Anti-inflammatory and anti-nociceptive activities of ethanolic extract and its various fractions from <i>Adiantum capillus veneris</i> Linn.	Haider et al ³⁶	2011	Anti-inflammatory and analgesic effects of Pare-siavashan were observed.
Ethnomedicinal studies on some Pteridophytes of Kanjamalai Hills, Salem district of Tamilnadu, India	Alagesaboopathi et al ³⁷	2017	The healing of cuts and wounds was accelerated.
Efficacy of <i>Adiantum capillus veneris</i> Linn in chemically induced urolithiasis in rats	Ahmed et al ³⁸	2013	Hydroalcoholic extract decreased the level of crystals, calcium, phosphorus, and serum urea. They introduced Pare-siavashan as a possible anti-urolithiatic drug.

divided into 5 groups: plants containing saponins that make it easier to expel mucus, plants containing essential oils that make digestion easier, diuretic plants that reduce edema, plants with antiseptic effects on the respiratory system, and laxative plants. The recommended medicinal compounds show that Iranian medical experts have considered all the mechanisms of shortness of breath.⁴³

Pare-siavashan has been mentioned as an effective drug in the treatment of "rabv".^{8,9,43} In the book of Tebe-Akbari, which a combination of pare-siavashan is one of its components, pare-siavashan has been mentioned as a treatment for two respiratory disorders: in the case that the moisture in the lungs and chest causes coughing, in the case that there is thick pus in the chest.⁴⁴

The present studies suggest that Pare-siavashan extract has the potential to be used as a natural source of the anti-inflammatory drugs.⁴⁵ Oral consumption of *A. capilluveneris* leaf decoction has been reported to be useful for cleaning the respiratory system, shortness of breath, asthma, coryza, bronchitis, cough, sore throat, and chest pain in the field of respiratory system.^{31,46}

The presence of mucilage in the plant facilitates the removal of mucous secretions from the respiratory system.³³ Researchers have shown that there are compounds in Pare-siavashan that control the programmed cell death of some respiratory cells due to severe exercise and are effective in the treatment of respiratory tract inflammation and cold.²⁹ In a study, Yuanyou and Yumin investigated the effect of Pare-siavashan on the treatment of rifampin-resistant tuberculosis and showed that the alcoholic extract of this plant can inhibit the proliferation of this microorganism.⁴⁷

In a study, the combination of Pare-siavashan, Licorice root, tukhm khatmi (*Althaea officinalis*), and tukhm khubbazi (*Malva sylvestris*) was used to treat asthma, and the result was satisfactory.⁴⁸

In a study, Javid et al investigated the effect of short-term administration of traditional herbal mixture containing *Matricaria chamomilla*, *Adiantum capilluveneris*, *Althaea officinalis*, *Malva sylvestris*, *Hyssopus officinalis*, *Glycyrrhiza glabra*, and *Ziziphus jujube* on asthma in children. A total of 46 children aged 7 to 12 years old at the onset of common cold symptoms were included in the study. They were divided into two groups who received a combination of traditional medicine and placebo for 5 days. It was observed that in the group receiving traditional medicine, the severity of coughs and night awakenings significantly decreased.⁴⁹

Histamine is one of the important mediators in allergy, inflammation, and contraction of bronchi. Excessive release of histamine leads to life-threatening consequences. In a study, guinea pigs were exposed to histamine aerosols. The resulting bronchospasm led to hypoxia, convulsions, and death in guinea pigs. In the case group, it was shown that the use of the ethanolic extract

of Pare-siavashan led to the protection of pigs from the adverse consequences of histamine.⁵⁰ In this study, guinea pigs were used because of the high sensitivity of their airways to histamine. Therefore, their reaction to histamine is partly similar to that seen in humans. Besides, enhanced bronchoconstriction occurs after sensitization, in response to β -adrenergic in the guinea pig model which is seen in asthmatic patients. Although this animal model resembles human allergic pathology in several aspects, there is still a great deal of work to be done in this area on patients.

The results of recent studies show that hypoxia and intense exercise activity lead to increased apoptosis of lung cells by increasing intracellular calcium, TNF- α , and P53. Pare-siavashan may play a preventive role in this process. The anti-inflammatory activity of Pare-siavashan is associated with some inflammatory mediators such as nitric oxide, TNF- α , and cyclooxygenase enzyme. Therefore, if the inflammation in the respiratory system is caused by the apoptosis of lung cells, the inhibition of apoptosis by Pare-siavashan is useful in controlling the inflammation.⁵¹

A similar issue has been considered in a recent study.⁵² The large airways of athletes who exercise in cold temperatures (high or moderate) show evidence of inflammation. An increase in the number of lymphocytes has been seen in the bronchoalveolar lavage of people who go cross-country skiing. Moreover, in the biopsy of the bronchi of these people, evidence of inflammation and changes in the airways were reported, which indicate a chronic airway disease called "skiers' asthma". Although the inflammation of the airways in professional athletes has a special pattern, the importance and mechanism of it have not been determined exactly. Since airway inflammation was not associated with bronchial hyperreactivity or respiratory symptoms after exercise in all cases and inflammatory cells were not necessarily activated after exercise, the asthma of skiers did not respond to inhaled steroids. The extract of Pare-siavashan may decrease the inflammation of athletes' airways; however, this subject needs further investigation.

Pulmonary surfactant reduces the surface tension in the liquid-air surface of the alveoli, stabilizes the alveoli, prevents the collapse of the alveoli during exhalation, increases lung compliance, reduces the work of breathing, and regulates defense against pulmonary infections and inflammatory response. Pulmonary surfactants are classified into four types, and surfactant protein A (SP-A) is the most abundant surfactant protein. It has been shown that the consumption of Pare-siavashan reduces the level of pulmonary surfactant type A and its consumption during exercise reduces the level of this surfactant, which probably stabilizes the structure of the lung parenchyma and reduces the harmful effect of exercise.⁵³ The ratios of SP-A to cholesterol and SP-A to saturated phospholipid

surfactants, as confounding variables, were not measured; therefore, there is a need for more research.

Some believe that Pare-siavashan has a protective effect against Covid-19 as a result of strengthening the immune system, and this effect is probably exerted through the inhibition of free radicals and anti-inflammatory effects.⁵⁴

In a review study, Tajadini et al studied the strategies to control common symptoms of Covid-19 from the perspective of Iranian medicine. They found that the consumption of *Glycyrrhiza glabra*, *Ficus carica*, *Cordia myxa*, *Echium amoenum*, and *Adiantum capillus veneris* was effective in relieving dyspnea.⁵⁵

To the best of our knowledge, there is no study which investigated the effectiveness of Pare-siavashan in treating respiratory diseases.

Conclusion

According to the sources of traditional medicine, Pare-siavashan has positive effects on some body systems, including the respiratory system (relieving respiratory ailments such as shortness of breath, cough, and cold). The antioxidant, anti-inflammatory, antimicrobial, and mucilaginous properties of this plant can justify the effectiveness of this plant in treating some diseases of the respiratory system. However, the lack of applied research in this field requires more effort in the context of clinical trials.

Authors' Contribution

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Competing Interests

The authors declare no conflict of interest in the present article.

Ethical Approval

Not applicable.

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References

1. Steppuhn H, Buda S, Wienecke A, et al. Time trends in incidence and mortality of respiratory diseases of high public health relevance in Germany. *J Health Monit*. 2017;2(3):3-33. doi:10.17886/rki-gbe-2017-061
2. Torkashvand Moradabadi M, Soroush V. A demographic study of mortality caused by respiratory diseases in Iran in the period from 2011 to 2018. *Nafas*. 2021;8(3):21-37.
3. Baskaran XR, Geo Vigila AV, Zhang SZ, Feng SX, Liao WB. A review of the use of pteridophytes for treating human ailments. *J Zhejiang Univ Sci B*. 2018;19(2):85-119. doi:10.1631/jzus.B1600344
4. Aghebati A, Safdari R, Dargahi H, Gushehgir SA, Saharkhiz P. Evaluation of information traditional medicine. *Journal of Islamic and Iranian Traditional Medicine*. 2014;5(3):263-269. [Persian].
5. Ahmed A, Jahan N, Wadud A, Imam H, Hajera S, Bilal A. Physicochemical and biological properties of *Adiantum capillus-veneris* Linn: an important drug of Unani system of medicine. *Int J Curr Res Rew*. 2012;4(21):70-75.
6. Shahrajabian MH, Sun W, Shen H, Cheng Q. Chinese herbal medicine for SARS and SARS-CoV-2 treatment and prevention, encouraging using herbal medicine for COVID-19 outbreak. *Acta Agric Scand B Soil Plant Sci*. 2020;70(5):437-443. doi:10.1080/09064710.2020.1763448
7. Emami A, Fasihi S, Mehregan I. Textbook of Medicinal Plants. 1st ed. Tehran: Institute of Medical History of Islamic and Complementary Medicine; 2010. [Persian].
8. Aghili Khorasani Shirazi MH. Makhzan-ol-Advieh. Tehran, Iran: Publications and Training of Islamic Revolution; 1992. [Persian].
9. Abu Nasr Neishaboori. Taghvim-ol-Adveieh. Tehran: Novin Pajoo Sina; 2018:471. [Persian].
10. Oliveira CR, Cal VD, Vaz DF, et al. Known and unknown medicinal plants used in respiratory disorders in Brazilian folk medicine: a brief review. *Braz J Nat Sci*. 2021;4(1):588-605. doi:10.31415/bjns.v4i1.130
11. Ibn Nafis. Alshamel Fi Senaat-o-Tebieh. Tehran: Safir Ardahal; 2019.
12. Mirheidary R, Esmaili Saber SS, Shaeiri MR, Gholami Fesharaki M. A survey and prioritizing of medicinal herbs effective on memory improvement in Iranian traditional medicine. *Med Hist*. 2019;10(35):7-19. [Persian].
13. Rabizadeh F. Introduction of kidney organ and its diseases and useful medicinal plants in traditional medicine and can be provided for classical treatments. *Med Hist*. 2021;12(45):1-24. [Persian].
14. Shirbeigi L, Ranjbar M. The effect of life style on healthy skin from the viewpoint of traditional Persian medicine (TPM) comparing to modern medicine. *Journal of Islamic and Iranian Traditional Medicine*. 2016;7(2):165-171. [Persian].
15. Al-Snafi AE. The chemical constituents and pharmacological effects of *Adiantum capillus-veneris*- a review. *Asian J Pharm Sci Technol*. 2015;5(2):106-111.
16. Zakir M, Ashraf N, Asad M, Minhajuddin M, Javed G. Ethnomedicinal properties of Parsioshan (*Adiantum capillus-veneris* L.): an important herb of the Unani system of medicine. *J Clin Otolaryngol Head Neck Surg*. 2022;26(2):21-36.
17. Nazim M, Aslam M, Chaudhary SS. Hansraj (*Adiantum capillus-veneris*): a review. *J Drug Deliv Ther*. 2018;8(5 Suppl):105-109. doi:10.22270/jddt.v8i5-s.2065
18. Khodadoust S, Ahmadvandi F, Zeraatpisheh F. Optimization of phenol and flavonoid extraction compound of *Adiantum capillus-veneris* L. using ultrasound assisted extraction. *J Med Plants*. 2020;19(75):312-326. doi:10.29252/jmp.19.75.312
19. Ishaq MS, Hussain MM, Afridi MS, et al. In vitro phytochemical, antibacterial, and antifungal activities of leaf, stem, and root extracts of *Adiantum capillus veneris*. *ScientificWorldJournal*. 2014;2014:269793. doi:10.1155/2014/269793
20. Vadi R, Manisha V, Swati K. Hansraj (*Adiantum capillus veneris* Linn.): a systematic review on its ethnobotany, phytochemical and pharmacological profile. *Int J Ayurveda Pharma Res*. 2017;5(6):5-21.
21. Rajurkar NS, Gaikwad K. Evaluation of phytochemicals, antioxidant activity and elemental content of *Adiantum*

- capillus veneris* leaves. J Chem Pharm Res. 2012;4(1):365-374.
22. Kashkooe A, Afsari Sardari F, Moradi Mehrabadi M, Zarshenas MM. A review of pharmacological properties and toxicological effects of *Adiantum capillus-veneris* L. Curr Drug Discov Technol. 2021;18(2):186-193. doi:10.2174/1570163817666200316111445
 23. Hoseinifar SH, Jahazi MA, Mohseni R, et al. Effects of dietary fern (*Adiantum capillus-veneris*) leaves powder on serum and mucus antioxidant defence, immunological responses, antimicrobial activity and growth performance of common carp (*Cyprinus carpio*) juveniles. Fish Shellfish Immunol. 2020;106:959-966. doi:10.1016/j.fsi.2020.09.001
 24. Ebadi N, Farjadmand F, Mehri M, et al. *Adiantum capillus veneris* L.: from Iranian traditional medicine to modern phytotherapy. Traditional and Integrative Medicine. Trad Integr Med. 2016;1(3):129-131.
 25. Vijayalakshmi A, Kiran Kumar Y. Evaluation of goitrogenic and antithyroidal effect of the fern *Adiantum capillus-veneris*. Rev Bras Farmacogn. 2013;23(5):802-810. doi:10.1590/s0102-695x2013000500013
 26. Jarial R, Shard A, Thakur S, et al. Characterization of flavonoids from fern *Cheilanthes tenuifolia* and evaluation of antioxidant, antimicrobial and anticancer activities. J King Saud Univ Sci. 2018;30(4):425-432. doi:10.1016/j.jksus.2017.04.007
 27. Ansari R, Ekhlas-Kazaj K. *Adiantum capillus-veneris*. L: phytochemical constituents, traditional uses and pharmacological properties: a review. J Adv Sci Res. 2012;3(4):15-20.
 28. Bahaeddin Z, Iranzadasl M, Ghaffari F, et al. Study and prioritization of effective materia medica used in the treatment of hair loss in Islamic and Iranian traditional medicines. Journal of Islamic and Iranian Traditional Medicine. 2020;11(3):237-250. [Persian].
 29. Yadegari M, Sellami M, Riahy S, et al. Supplementation of *Adiantum capillus-veneris* modulates alveolar apoptosis under hypoxia condition in Wistar rats exposed to exercise. Medicina (Kaunas). 2019;55(7):401. doi:10.3390/medicina55070401
 30. Stuart M. The Encyclopedia of Herbs and Herbalism. New York: Grosset & Dunlap; 1979.
 31. Dehdari S, Hajimehdipoor H. Medicinal properties of *Adiantum capillus-veneris* Linn. in traditional medicine and modern phytotherapy: a review article. Iran J Public Health. 2018;47(2):188-197.
 32. Mohammed FS, Sevindik M, Bal C, Akgül H, Selamoglu Z. Biological activities of *Adiantum capillus-veneris* collected from Duhok province (Iraq). Communications Faculty of Sciences University of Ankara Series C Biology. 2019;28(2):128-142. doi:10.1501/commuc_0000000235
 33. Shirazi M, Amin G, Akhondi Lavasani B, Eshraghi SS. Study of antibacterial properties of *Adiantum capillus-veneris* extract on eight species of gram positive and negative bacteria. J Med Plants. 2011;10(40):124-132. [Persian].
 34. Hussein HM, Hameed IH, Ibrahim OA. Antimicrobial activity and spectral chemical analysis of methanolic leaves extract of *Adiantum capillus-veneris* using GC-MS and FT-IR spectroscopy. Int J Pharmacogn Phytochem Res. 2016;8(3):369-385.
 35. Negi A, Maurya VK. Antibacterial potential of antimicrobial peptides containing whole proteins of two *Adiantum* species from Himalaya against selected human bacterial pathogens. Int J Res Pharm Sci. 2020;11(2):2603-2613. doi:10.26452/ijrps.v11i2.2269
 36. Haider S, Nazreen S, Alam MM, Gupta A, Hamid H, Alam MS. Anti-inflammatory and anti-nociceptive activities of ethanolic extract and its various fractions from *Adiantum capillus veneris* Linn. J Ethnopharmacol. 2011;138(3):741-747. doi:10.1016/j.jep.2011.10.012
 37. Alagesaboopathi C, Subramanian G. Ethnomedicinal studies on some pteridophytes of Kanjamalai Hills, Salem district of Tamilnadu, India. World J Pharm Res. 2017;6(8):1590-1596. doi:10.20959/wjpr20178-9034
 38. Ahmed A, Wadud A, Jahan N, Bilal A, Hajera S. Efficacy of *Adiantum capillus veneris* Linn in chemically induced urolithiasis in rats. J Ethnopharmacol. 2013;146(1):411-416. doi:10.1016/j.jep.2013.01.011
 39. Boukada F, Sitayeb S, Khadem H, Meddah B, Zohra SF. Chemical composition, antioxidant and antibacterial activity of *Adiantum capillus-veneris* L. extract from Algeria. Kragujev J Sci. 2022(44):91-101. doi:10.5937/KglSci2244091B
 40. Mitchell I, Govias G. Asthma Education. 2nd ed. Switzerland: Springer; 2021.
 41. Amini F, Jaladat AM, Atarzadeh F, Mosavat SH, Parvizi MM, Zamani N. A review on the management of asthma in the Avicenna's Canon of Medicine. J Complement Integr Med. 2019;16(4):20180148. doi:10.1515/jcim-2018-0148
 42. Paknejad MS, Shahkarami E. Did ancient Iranian physicians know asthma? Iran J Allergy Asthma Immunol. 2018;17:167-168.
 43. Soltani A. Dyspnea and asthma in Iranian traditional medicine. Journal of Islamic and Iranian Traditional Medicine. 2010;1(3):203-216. [Persian].
 44. Arzani MA. Teb-e-Akbari. Qom: Jalal Adin; 2008. [Persian].
 45. Yuan Q, Zhang X, Liu Z, et al. Ethanol extract of *Adiantum capillus-veneris* L. suppresses the production of inflammatory mediators by inhibiting NF- κ B activation. J Ethnopharmacol. 2013;147(3):603-611. doi:10.1016/j.jep.2013.03.046
 46. Kumar D, Arya P. Some immunity-boosting plants used during the COVID-19 pandemic to prevent corona virus infection in Kumaun Himalyan region of Uttarakhand, India. Plant Arch. 2021;21(2):510-517. doi:10.51470/PLANTARCHIVES.2021.v21.no2.078
 47. Yuanyou T, Yumin X. Effects of the alcohol extracts from rhizoma *Adiantum capillus-veneris* on rifampicin-resistant pulmonary tuberculosis cells. Journal of Wuhan Institute of Science and Technology. 2003;16(3):79-83.
 48. Shamsi Y, Khan R, Nikhat S. Clinically significant improvement in a case of bronchial asthma with Unani medicine: a case report. Trad Integr Med. 2019;4(3):130-136.
 49. Javid A, Motevalli Haghi N, Emami SA, et al. Short-course administration of a traditional herbal mixture ameliorates asthma symptoms of the common cold in children. Avicenna J Phytomed. 2019;9(2):126-133.
 50. Swaroop Kumar K, Anbu J, Anjana A, Sumithra M, Sathish R. Influence of ethanolic leaf extract of *Sargassum wightii* and *Adiantum capillus* on histamine induced asthma in animal model. Int J Pharm Pharm Sci. 2012;4 Suppl 4:121-123.
 51. Yadegari M, Riahy S, Mirdar S, et al. The TNF- α , P53 protein response and lung respiratory changes to exercise, chronic hypoxia and *Adiantum capillus-veneris* supplementation. Adv Respir Med. 2019;87(4):226-234. doi:10.5603/arm.2019.0037
 52. Chimenti L, Morici G, Paternò A, et al. Endurance training damages small airway epithelium in mice. Am J Respir Crit Care Med. 2007;175(5):442-449. doi:10.1164/rccm.200608-1086OC
 53. Hosseini SH, Mirdar Harijani S, Hedayati M. Effect of interval training along with *Adiantum capillus-veneris* Linn supplement on surfactant protein (SP-A) in lung male rats. Journal of Practical Studies of Biosciences in Sport. 2020;8(15):50-61. doi:10.22077/jpsbs.2018.1038.1322
 54. Saeidi A, Tayebi SM, To-Aj O, et al. Physical activity and

natural products and minerals in the SARS-CoV-2 pandemic: an update. *Ann Appl Sport Sci.* 2021;9(1):e976. doi:[10.29252/aassjournal.976](https://doi.org/10.29252/aassjournal.976)

55. Tajadini H, Kamali M. Effective strategies for controlling

common symptoms of respiratory diseases with emphasis on COVID-19 from the perspective of Persian medicine: narrative review. *J Mil Med.* 2020;22(11):1110-1120. [Persian].