Ilam University of Medical Sciences

Plant Biotechnology Persa

Online ISSN: 2676-7414

Homepage: https://pbp.medilam.ac.ir

Anti-Influenza Medicinal Plants: A Phytotherapeutic Review of Mechanisms and Efficacy

Rahim Asghari[1], **Somayeh Mohammadi** [2]✉

[1]Department of Internal Medicine, School of Medicine, Imam Khomeini Hospital, Urmia University of Medical Sciences, Urmia, Iran
[2]Student Research Committee, Ilam University of Medical Sciences, Ilam, Iran

Article Info

Article type:
Review Article

Article History:
Received: 07 Nov 2024
Revised: 13 Jan 2025
Accepted: 19 Jan 2025
Published Online: 20 Sep 2025

✉ ***Correspondence to:***
Somayeh Mohammadi

Email:
sm9589920@gmail.com

A B S T R A C T

Objective: Influenza is a common viral illness that primarily affects the respiratory system, often presenting with symptoms such as fever, cough, sore throat, and body aches. Due to the limitations of conventional treatments and their potential side effects, phytotherapy or the use of medicinal plants—has gained increasing attention as a complementary approach to managing the disease. This review aims to explore the therapeutic potential of medicinal plants used for treating influenza, analyzing their mechanisms of action in light of both traditional medicine and contemporary scientific evidence.
Methodology: In this narrative review, relevant keywords such as "influenza," "traditional medicine," "medicinal plants," and "treatment" were searched across several academic databases, including Google Scholar, SID, Magiran, and Scopus. Irrelevant studies were excluded, and those deemed relevant were selected for further analysis.
Results: According to the findings, a variety of medicinal plants have been traditionally used in the treatment of influenza and cold-like symptoms in children. These include *Curcuma longa* L., *Zingiber officinale* Roscoe, *Echinacea purpurea* (L.) Moench, *Salvia officinalis* L., *Mentha piperita* L., *Camellia sinensis* (L.) Kuntze, *Allium sativum* L., *Piper nigrum* L., *Cinnamomum verum* J. Presl, *Hypericum perforatum* L., *Vaccinium myrtillus* L., *Echinacea angustifolia* DC., *Glycyrrhiza glabra* L., *Matricaria chamomilla* L., *Thymus vulgaris* L., *Urtica dioica* L., *Sideritis scardica* Griseb., *Tribulus terrestris* L., *Aloe vera* (L.) Burm.f., *Crocus sativus* L., *Melissa officinalis* L., *Eucalyptus globulus* Labill., and *Origanum vulgare* L.. Among these, the Lamiaceae family accounts for the highest proportion (26.1%), followed by Asteraceae (17.4%) and Zingiberaceae (8.7%). Collectively, Lamiaceae and Asteraceae represent over 43% of all cited species, suggesting a traditional emphasis on these botanical families for their anti-influenza properties. In terms of therapeutic attributes, antiviral effects were most frequently reported (39.1%), followed by immune-boosting properties (34.8%), with anti-inflammatory and symptom-relieving effects each cited in 26.1% of the sources. Additional effects—such as antimicrobial, respiratory symptom relief, and mild sedative action—were also noted, albeit with lower frequencies. Overall, the focus of these plant-based interventions lies primarily in their antiviral and immunomodulatory properties, with secondary benefits supporting symptom management.
Conclusion: This review underscores the potential role of various medicinal plants in the complementary management of influenza. Given the prevalence and symptomatic burden of the illness, phytotherapy may serve as a safe and effective adjunct to conventional treatments, particularly in high-risk populations such as children. Nevertheless, further clinical trials are warranted to confirm the safety, efficacy, and optimal dosage of these plant-based remedies in human populations.
Keywords: Infection, Virus, Influenza, Medicinal Plants, Treatment

➢ **How to cite this paper**
Asghari R, Mohammadi S. Anti-Influenza Medicinal Plants: A Phytotherapeutic Review of Mechanisms and Efficacy. Plant Biotechnology Persa. 2025; 7(4): 151-157. DOI: 10.61882/pbp.7.4.4

[DOI: 10.61882/pbp.7.4.4]

Introduction

Influenza is an acute viral respiratory illness caused by viruses of the Orthomyxoviridae family, including types A, B, and C [1]. Characterized by its rapid and widespread transmissibility especially during the colder months of the year it affects millions of individuals annually and imposes significant strain on healthcare systems [1]. Influenza viruses are primarily transmitted through respiratory droplets expelled by coughing or sneezing [2]. The typical clinical manifestations include sudden onset of fever, cough, sore throat, myalgia, headache, chills, and general fatigue. While in most healthy individuals

Publisher: Ilam University of Medical Sciences

the disease is self-limiting and recovery occurs without complications [3], certain high-risk populations such as the elderly, young children, pregnant women, and individuals with underlying conditions—are more susceptible to serious complications, including pneumonia, secondary bacterial infections, and in some cases, death [3].

Transmission occurs via multiple routes. The most common is through inhalation of aerosolized droplets released during sneezing, coughing, or even speaking, which allows the virus to enter the respiratory tract of nearby individuals [4]. Fomite transmission is another significant mode, wherein contact with contaminated surfaces followed by touching the mouth, nose, or eyes facilitates viral entry [5].

The incubation period generally ranges from 1 to 4 days, and infected individuals can spread the virus from one day before symptom onset to approximately seven days thereafter [6]. During this window, even asymptomatic carriers or those with mild symptoms can act as vectors of transmission [6]. Emphasis on personal hygiene and minimizing unnecessary contact during this period plays a vital role in curbing the spread of the virus [7].

Pharmacological management typically involves antiviral agents such as oseltamivir, zanamivir, and peramivir, which function by inhibiting the neuraminidase enzyme, thereby preventing viral replication and propagation [8]. However, a critical challenge in treatment remains the emergence of antiviral resistance [8]. Due to the genetic plasticity and high mutation rate of influenza viruses, the evolution of novel and drug-resistant strains is a persistent concern. These mutations diminish therapeutic efficacy and complicate disease control efforts [9].

Drug resistance primarily arises through two mechanisms: spontaneous mutations during viral RNA replication, and selective pressure exerted by inappropriate or excessive use of antiviral drugs, both of which contribute to the emergence and dissemination of resistant strains [9]. The development of such strains not only reduces the effectiveness of existing therapies but may also prolong illness duration and elevate the risk of complications [9].

Under these circumstances, complementary approaches such as phytotherapy have garnered increasing attention as potential alternatives in influenza management [10]. Rooted in traditional medicine, phytotherapy involves the use of medicinal plants to prevent and treat various diseases [11]. Numerous medicinal herbs exhibit antiviral, anti-inflammatory, and immunomodulatory properties, acting through mechanisms such as inhibition of viral replication, reduction of inflammatory responses, and enhancement of innate immunity. Additionally, due to their generally favorable safety profiles and better physiological compatibility, medicinal plants are particularly well-received in communities inclined toward natural therapies [12]. Historically, these herbs have been used to alleviate respiratory ailments, and more recently, they have gained recognition as supportive treatments alongside conventional therapies [13,14].

Given the limitations of current pharmacological interventions and the growing threat of drug resistance, the present study aims to review the therapeutic effects of medicinal plants on influenza, focusing on their mechanisms of action as understood through both traditional medicine and modern scientific research. Emphasis is placed on the role of these plants as complementary strategies for improved disease management and resistance mitigation.

Methodology

This review study aimed to identify and report medicinal plants traditionally used in Iranian medicine for the treatment of influenza. Inclusion criteria comprised scientific articles and traditional evidence related to the application of medicinal plants in influenza treatment, published in either English or Persian. Non-scientific or unrelated publications were excluded. The literature search was conducted using electronic databases such as Google Scholar, SID, Magiran, and Scopus.

Results

According to the findings of this review, medicinal plants such as turmeric, ginger, echinacea, sage, peppermint, green tea, garlic, cinnamon, and several others have been traditionally utilized in the treatment of influenza and the common cold, particularly among children. Additional information including the Persian name, English name, scientific name, botanical family, and proposed mechanism of action is presented in Table 1.

Table 1: Medicinal Plants Used for Influenza Treatment in Traditional Iranian Medicine [15−28]

[DOI: 10.61882/pbp.7.4.4]

Persian Name	English Name	Scientific Name	Botanical Family	Mechanism of Action
Zardchoubeh	Turmeric	*Curcuma longa* L.	Zingiberaceae	Exhibits antiviral and anti-inflammatory properties
Zanjabil	Ginger	*Zingiber officinale* Roscoe	Zingiberaceae	Demonstrates antiviral activity and alleviates flu-related symptoms
Ekinaseh	Echinacea	*Echinacea purpurea* (L.) Moench	Asteraceae	Enhances immune function and provides antiviral protection
Maryamgoli	Sage	*Salvia officinalis* L.	Lamiaceae	Possesses anti-inflammatory and soothing properties
Naenafelfeli	Peppermint	*Mentha piperita* L.	Lamiaceae	Relieves respiratory symptoms and offers antiviral effects
Chayesabz	Green Tea	*Camellia sinensis* (L.) Kuntze	Theaceae	Provides antioxidant and antiviral effects
Sir	Garlic	*Allium sativum* L.	Amaryllidaceae	Strengthens the immune system and exhibits antiviral activity
Felfelesian	Black Pepper	*Piper nigrum* L.	Piperaceae	Has antimicrobial effects and helps relieve symptoms
Darchin	Cinnamon	*Cinnamomum verum* J. Presl	Lauraceae	Displays antiviral and anti-inflammatory actions
Alafechay	St. John's Wort	*Hypericum perforatum* L.	Hypericaceae	Facilitates symptom relief and provides antiviral effects
Zoghalakhte	Cranberry	*Vaccinium myrtillus* L.	Ericaceae	Supports immune function and demonstrates antiviral efficacy
Sarkhargol	Echinacea	*Echinacea angustifolia* DC.	Asteraceae	Supports immune function and demonstrates antiviral efficacy
Shirinbayan	Licorice	*Glycyrrhiza glabra* L.	Fabaceae	Reduces inflammation and eases clinical symptoms
Babouneh	Chamomile	*Matricaria chamomilla* L.	Asteraceae	Acts as a mild sedative with anti-inflammatory potential
Avishanebaqi	Garden Thyme	*Thymus vulgaris* L.	Lamiaceae	Exhibits antimicrobial activity and boosts immune responses
Gazaneh	Nettle	*Urtica dioica* L.	Urticaceae	Offers anti-inflammatory support and enhances immune defense
Chayekouhi	Mountain Tea	*Sideritis scardica* Griseb.	Lamiaceae	Combines antiviral properties with symptom-relieving effects
Kharkhasak	Tribulus Terrestris	*Tribulus terrestris* L.	Zygophyllaceae	Functions as an immune stimulant
Aloevera	Aloe Vera	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Provides calming effects and supports immune health
Zafaran	Saffron	*Crocus sativus* L.	Iridaceae	Acts as an antidepressant and strengthens immune responses
Badranjbouyeh	Lemon Balm	*Melissa officinalis* L.	Lamiaceae	Serves as a sedative and alleviates influenza-related symptoms
Okaliptus	Eucalyptus	*Eucalyptus globulus* Labill.	Myrtaceae	Possesses antimicrobial action and alleviates respiratory discomfort
Pounekouhi	Oregano	*Origanum vulgare* L.	Lamiaceae	Combines antimicrobial efficacy with immune-enhancing potential

Distribution Analysis of Botanical Families and Therapeutic Mechanisms

In this review, the Lamiaceae family was the most frequently represented, accounting for six occurrences (26.1%) among the

[DOI: 10.61882/pbp.7.4.4]

selected medicinal plants. It was followed by the Asteraceae family with four entries (17.4%), while the Zingiberaceae family appeared twice (8.7%), reflecting a noteworthy proportion. Other families were each represented only once, making up 4.3% of the total individually. This distribution suggests a clear emphasis on plants from the Lamiaceae and Asteraceae families in traditional Iranian medicine for managing influenza, collectively comprising over 43% of all reviewed cases. In contrast, the remaining families appear sporadically with lower frequencies.

With regard to mechanisms of action, antiviral activity was the most prevalent attribute, cited in nine cases (39.1%), followed closely by immune-boosting effects, reported in eight entries (34.8%). Anti-inflammatory properties and symptom relief each occurred six times (26.1%). Antimicrobial effects were noted in four cases (17.4%), while respiratory or flu symptom relief appeared in three cases (13%), and sedative effects in two instances (8.7%). Additional features such as antioxidant, antidepressant, and symptom alleviation were each observed only once (4.3%). These findings emphasize the central therapeutic focus on antiviral action and immune support, with other properties considered secondary contributors to treatment outcomes

Discussion

Given the widespread prevalence of viral infections, medicinal plants have gained considerable attention as an effective and natural approach for the prevention and treatment of these conditions, particularly influenza. Due to their rich content of bioactive compounds such as flavonoids, terpenoids, and antioxidants these plants contribute significantly to immune modulation and inflammation reduction [29].

Curcuma longa (turmeric) contains curcumin, a potent compound with both anti-inflammatory and antioxidant properties. It has been traditionally used in Indian and Chinese medicine as a spice and therapeutic agent for inflammatory conditions [30]. *Zingiber officinale* (ginger), which contains active constituents like gingerol and shogaol, exhibits notable antiviral and soothing properties and is commonly used for relieving cold and flu symptoms [31]. *Echinacea purpurea*, rich in polysaccharides and alkamides, enhances immune responses and is widely recognized as a natural remedy for cold and influenza prevention [32].

Salvia officinalis (sage) contains terpenoids and phenolic acids with anti-inflammatory and antiseptic properties and is commonly consumed as an herbal tea to relieve sore throat and respiratory infections [33]. *Mentha piperita* (peppermint), with its primary constituent menthol, helps open airways and relieve symptoms, and is used in infusions for respiratory relief and headache treatment [34]. *Camellia sinensis* (green tea) provides catechins and polyphenols known for their antioxidant and antiviral properties and is widely consumed to support immune health and general well-being [35].

Allium sativum (garlic), which contains allicin, exhibits strong antimicrobial and antiviral effects and is regarded as a traditional remedy across cultures for infection prevention [36]. *Piper nigrum* (black pepper), rich in piperine, enhances nutrient absorption and supports immune function, and is traditionally used for digestive health [37]. *Cinnamomum verum* (cinnamon) contains cinnamaldehyde, offering antiviral and anti-inflammatory effects useful for treating colds and sore throat [38]. *Hypericum perforatum* (St. John's Wort), known for its content of hyperforin, provides both antiviral and anxiolytic properties and is commonly used for depression and anxiety [39].

Vaccinium myrtillus (bilberry) is rich in anthocyanins, which contribute to immune enhancement and are frequently included in extracts and supplements for immune support [40]. *Echinacea angustifolia* shares similar immunostimulatory effects with E. purpurea [41]. *Glycyrrhiza glabra* (licorice), which contains glycyrrhizin, demonstrates both anti-inflammatory and antiviral activities and is used to treat coughs and respiratory infections [42]. *Matricaria chamomilla* (chamomile) offers calming and anti-inflammatory effects due to its flavonoid content and is widely consumed for anxiety relief and sleep support [43].

Thymus vulgaris (garden thyme), with its thymol content, has antimicrobial and immune-boosting properties and is used to manage coughs and respiratory ailments [44]. *Urtica dioica* (nettle) contains phenolic compounds that aid in inflammation reduction and immune strengthening, traditionally used for respiratory and allergic conditions [45]. *Sideritis scardica* (mountain tea) is rich in flavonoids, supporting inflammation reduction and immune function [46]. *Tribulus terrestris* is known for its saponins, which help boost immunity and reduce fatigue, often used as an herbal tonic for energy and endurance [47].

Aloe vera has well-documented soothing and anti-inflammatory effects and is traditionally applied to treat wounds and skin conditions. *Crocus sativus* (saffron), rich in crocin and safranal, provides antidepressant and immunostimulatory properties and is both a culinary spice and a traditional remedy for mood enhancement and vitality [48]. *Melissa officinalis* (lemon balm) has mild sedative and antiviral properties and is used to treat anxiety and sleep disorders [49]. *Eucalyptus globulus* (eucalyptus), containing cineole, has antimicrobial properties and is often inhaled as steam or applied in solutions for cough relief [50]. *Origanum vulgare* (oregano) contains carvacrol, a compound with potent antimicrobial and immune-enhancing effects, and is used in traditional medicine for infections and digestive issues [51]. In many diseases and disorders [52-56], turning to nature and embracing traditional or natural therapeutic approaches can

[DOI: 10.61882/pbp.7.4.4]

serve as a beneficial and complementary strategy helping to alleviate symptoms, support overall well-being, and enhance patients' quality of life [57]. Medicinal plants and plant-based antioxidants can serve as a suitable source for the antimicrobial properties [].

Conclusion

The growing interest in medicinal plants as a complementary and natural approach to managing influenza is supported by their ability to alleviate symptoms, modulate inflammation, and enhance immune function. The bioactive compounds present in these herbs not only aid in the reduction of flu-related discomfort but also contribute to disease prevention through immune system support. Integrating phytotherapeutic strategies with modern medical treatments may offer improved clinical outcomes, promote general well-being, and serve as a safe, accessible resource for communities seeking holistic health solutions.

References

1. Hutchinson EC. Influenza virus. Trends Microbiol. 2018;26(9):809–10. doi: 10.1016/j.tim.2018.05.013.
2. Kilbourne ED. Influenza. New York: Springer Science & Business Media; 2012.
3. Potter CW. A history of influenza. J Appl Microbiol. 2001;91(4):572–9.
4. Cannell JJ, Zasloff M, Garland CF, Scragg R, Giovannucci E. On the epidemiology of influenza. Virol J. 2008;5:1–12. doi: 10.1186/1743-422X-5-29.
5. Zambon MC. Epidemiology and pathogenesis of influenza. J Antimicrob Chemother. 1999;44(Suppl_2):3–9. doi: 10.1093/jac/44.suppl_2.3.
6. Suarez DL. Influenza A virus. In: Animal Influenza. 2016. p. 1–30.
7. Webster RG. Influenza: an emerging disease. Emerg Infect Dis. 1998;4(3):436.
8. Kilbourne ED. Influenza pandemics of the 20th century. Emerg Infect Dis. 2006;12(1):9. doi: 10.3201/eid1201.051254.
9. Hussain M, Galvin HD, Haw TY, Nutsford AN, Husain M. Drug resistance in influenza A virus: the epidemiology and management. Infect Drug Resist. 2017;10:121–34. doi: 10.2147/IDR.S105473.
10. Palese P. Influenza: old and new threats. Nat Med. 2004;10(Suppl 12): 82–7.
11. Akram M, Tahir IM, Shah SMA, Mahmood Z, Altaf A, Ahmad K, et al. Antiviral potential of medicinal plants against HIV, HSV, influenza, hepatitis, and coxsackievirus: A systematic review. Phytother Res. 2018;32(5): 811–22.
12. Rajasekaran D, Palombo EA, Chia Yeo T, Lim Siok Ley D, Lee Tu C, Malherbe F, et al. Identification of traditional medicinal plant extracts with novel anti-influenza activity. PLoS One. 2013;8(11): 79293. https://doi.org/10.1371/journal.pone.0079293
13. Adetunji CO, Ajayi OO, Akram M, Olaniyan OT, Chishti MA, Inobeme A, et al. Medicinal plants used in the treatment of influenza A virus infections. In: Medicinal Plants for Lung Diseases: A Pharmacological and Immunological Perspective. 2021. p. 417–35.
14. Mehrbod P, Abdalla MA, Njoya EM, Ahmed AS, Fotouhi F, Farahmand B, et al. South African medicinal plant extracts active against influenza A virus. BMC Complement Altern Med. 2018;18:1–10.
15. Avicenna. The Canon of Medicine. Grant DP, translator. New York: AMS Press; 1999.
16. Najmabadi M. History of Persian Medicine. Tehran: Iran University of Medical Sciences Press; 2013.
17. Jorjani A. Zakhireh Khwarazmshahi (The Treasure of Khwarazmshah). Ghaffari M, translator. Tehran: Tehran University Press; 2005.
18. Kermani S. Traditional Iranian Herbal Medicine. Tehran: Rasa Publications; 2016.
19. Razi M. Al-Hawi (The Comprehensive Book). Barjasteh R, translator. Tehran: Tabriz University Press; 2010.
20. Khorsand M, Haghshenas S. Medicinal Plants in Iranian Traditional Medicine. Tehran: Shahed University Press; 2011.
21. Tayarani-Najaran Z, Zargari A. Pharmacognosy and Medicinal Plants in Iranian Traditional Medicine. Tehran: Tehran University Press; 2014.
22. Faridi P. Traditional Persian Medicine. Tehran: Institute for the History of Science and Technology; 2013.
23. Saeedian R. Herbal Medicines in Persian Traditional Pharmacology. Tehran: Tarbiat Modares University Press; 2015.
24. Shams-Ardekani M, Jafari M. The Role of Iranian Herbal Medicine in Modern Treatment Methods. Tehran: PNU Press; 2017.
25. Bakhru H. Herbs That Heal: Medicinal Plants in Persian Medicine. Tehran: Arya Press; 2010.
26. Mokhlesi Z. The Medicinal Plants of Iran. Tehran: Islamic Azad University Press; 2018.
27. Ghaffari M. Persian Materia Medica: Medicinal Plants of Iran. Tehran: University of Medical Sciences Press; 2009.

Statements and Declarations

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Acknowledgments

The authors would like to express their gratitude to the clinical research development unit of Imam Khomeini Hospital, Urmia University of Medical Sciences, for English editing.

[DOI: 10.61882/pbp.7.4.4]

28. Ebrahimi S, Sahebkar A. Herbal Therapy in Iranian Traditional Medicine. Tehran: Razi Medical Sciences University Press; 2020.
29. Wang X, Jia W, Zhao A, Wang X. Anti-influenza agents from plants and traditional Chinese medicine. Phytother Res. 2006;20(5):335–41. doi: 10.1002/ptr.1892.
30. Dao TT, Nguyen PH, Won HK, Kim EH, Park J, Won BY, et al. Curcuminoids from Curcuma longa and their inhibitory activities on influenza A neuraminidases. Food Chem. 2012;134(1):21–8.
31. Ahmed I, Aslam A, Mustafa G, Masood S, Ali MA, Nawaz M. Anti-avian influenza virus H9N2 activity of aqueous extracts of Zingiber officinalis (Ginger) and Allium sativum (Garlic) in chick embryos. Pak J Pharm Sci. 2017;30(4):1341–4. PMID: 29039335
32. Fusco D, Liu X, Savage C, Taur Y, Xiao W, Kennelly E, et al. Echinacea purpurea aerial extract alters course of influenza infection in mice. Vaccine. 2010;28(23):3956–62. doi: 10.1016/j.vaccine.2010.03.047.
33. Abou Baker DH, Amarowicz R, Kandeil A, Ali MA, Ibrahim EA. Antiviral activity of Lavandula angustifolia L. and Salvia officinalis L. essential oils against avian influenza H5N1 virus. J Agric Food Res. 2021;4:100135.
34. Protsenko MA, Mazurkova NA, Filippova EI, Kukushkina TA, Lobanova IE, Pshenichkina YA, et al. Anti-Influenza Activity of Extracts from Plants of the Lamiaceae Family. Russ J Bioorg Chem. 2022;48(7):1534–41. doi: 10.15372/KhUR2023468
35. Karimi A, Asadi-Samani M, Altememy D, Moradi MT. Anti-influenza and anti-inflammatory effects of green tea (Camellia sinensis L.) extract. Future Nat Prod. 2022;8(2):59–64. https://doi.org/10.34172/fnp.2022.10
36. Chavan RD, Shinde P, Girkar K, Madage R, Chowdhary A. Assessment of anti-influenza activity and hemagglutination inhibition of Plumbago indica and Allium sativum extracts. Pharmacogn Res. 2016;8(2):105. doi: 10.4103/0974-8490.172562
37. Priya NC, Kumari PS. Antiviral activities and cytotoxicity assay of seed extracts of Piper longum and Piper nigrum on human cell lines. Int J Pharm Sci Rev Res. 2017;44(1):197–202.
38. Karadağ AE, Biltekin SN, Ghani U, Demirci B, Demirci F. Enzyme-Based Antiviral Potential of Cinnamomum verum J. Presl. Essential Oil and Its Major Component (E)-Cinnamaldehyde. ACS Omega. 2024;9(12):14118–22. doi: 10.1021/acsomega.3c09595.
39. Pu XY, Liang JP, Wang XH, Xu T, Hua LY, Shang RF, et al. Anti-influenza A virus effect of Hypericum perforatum L. extract. Virol Sin. 2009;24:19–27.
40. Gramza-Michałowska A, Sidor A, Kulczyński B. Berries as a potential anti-influenza factor–A review. J Funct Foods. 2017;37:116–37.
41. Senchina DS, Wu L, Flinn GN, Konopka DN, McCoy JA, Widrelechner MP, et al. Year-and-a-half old, dried Echinacea roots retain cytokine-modulating capabilities in an in vitro human older adult model of influenza vaccination. Planta Med. 2006;72(13):1207–15.
42. Alexyuk PG, Bogoyavlenskiy AP, Alexyuk MS, Turmagambetova AS, Zaitseva IA, Omirtaeva ES, et al. Adjuvant activity of multimolecular complexes based on Glycyrrhiza glabra saponins, lipids, and influenza virus glycoproteins. Arch Virol. 2019;164(7):1793–803.
43. Chiru T, Fursenco C, Ciobanu N, Dinu M, Popescu E, Ancuceanu R, et al. Use of medicinal plants in complementary treatment of the common cold and influenza–perception of pharmacy customers in Moldova and Romania. J Herb Med. 2020;21:100346.
44. Catella C, Camero M, Lucente MS, Fracchiolla G, Sblano S, Tempesta M, et al. Virucidal and antiviral effects of Thymus vulgaris essential oil on feline coronavirus. Res Vet Sci. 2021;137:44–7.
45. Gaafar AA, Ali SI, Kutkat O, Kandeil AM, El-Hallouty SM. Bioactive Ingredients and Anti-influenza (H5N1), Anticancer, and Antioxidant Properties of Urtica urens L. Jordan J Biol Sci. 2020;13.
46. Sargin SA. Potential anti-influenza effective plants used in Turkish folk medicine: A review. J Ethnopharmacol. 2021;265:113319.
47. Yazdi FF, Ghalamkari G, Toghyani M, Modaresi M, Landy N. Efficiency of Tribulus terrestris L. as an antibiotic growth promoter substitute on performance and immune responses in broiler chicks. Asian Pac J Trop Dis. 2014;4(Suppl 1):S1014–8.
48. Choi JG, Lee H, Kim YS, Hwang YH, Oh YC, Lee B, et al. Aloe vera and its components inhibit influenza A virus-induced autophagy and replication. Am J Chin Med. 2019;47(6):1307–24.
49. Pourghanbari G, Nili H, Moattari A, Mohammadi A, Iraji A. Antiviral activity of the oseltamivir and Melissa officinalis L. essential oil against avian influenza A virus (H9N2). Virusdisease. 2016;27:170–8.
50. Mieres-Castro D, Ahmar S, Shabbir R, Mora-Poblete F. Antiviral activities of eucalyptus essential oils: Their effectiveness as therapeutic targets against human viruses. Pharmaceuticals. 2021;14(12):1210.
51. Vimalanathan S, Hudson J. Anti-Influenza virus activities of commercial oregano oils and their carriers. J Appl Pharm Sci. 2012;2(7):214–8.
52. Mahmud Hussen B, Noori M, Sayad B, Ebadi Fard Azar M, Sadri Nahand J, Bayat M, Babaei F, Karampour R, Bokharaei-Salim F, Mirzaei H, Moghoofei M. New potential MicroRNA biomarkers in human immunodeficiency virus elite controllers, human immunodeficiency virus infections, and coinfections with hepatitis B virus or hepatitis C virus. Intervirology. 2023 Dec 20;66(1):122–135.
53. Ghanbari A, Nouri M, Darvishi M. Evaluation of relationship between serum hemoglobin A1C level and severity of diabetic foot ulcers based on Wagner criteria. J Med Chem Sci. 2023;6:2234–2241.
54. Darvishi M, Nouri M, Zahir M, Asli M, Hejripoor SZ, Karimi E. Overview of human papillomavirus infection. Infect Disord Drug Targets. 2024 Mar 1;24(2):65–76.
55. Nouri M, Kamakifar P, Khodabandehlou N, Nahand JS, Tavakoli A, Norooznezhad F, Sorayyayi S, Babaei F, Mostafaei S, Moghoofei M. Association between Parvovirus B19 and anemia in HIV-infected patients. Med J Islam Repub Iran. 2019 Dec 16;33:137.
56. Darvishi M, Noori M, Nazer MR, Soleiman-Meigooni S, Forootan M. The relationship between Helicobacter pylori

[DOI: 10.61882/pbp.7.4.4]

and extra-gastrointestinal infections. Iran J Med Microbiol. 2020 Nov 10;14(6):543–565.
57. Darvishi M, Hashemi Rafsanjani SMR, Nouri M, Abbaszadeh S, Heidari-Soureshjani S, Kasiri K, Rahimian G. Biological mechanisms of polyphenols against Clostridium difficile: A systematic review. Infect Disord Drug Targets. 2025 May;25(3): 18715265313944. doi: 10.2174/0118715265313944240726115600
58. Habibi Z, Imanpour Namin J, Remazanpour Z. Evaluation of antimicrobial properties of diethyl ether and methanol extracts of Scenedesmus dimorphus against bacterial Micrococcus lutesus and Aeromonas hydrophila. *Aquatic Animals Nutrition*, 2017; 3(1): 35-45. doi: 10.22124/janb.2017.3154
59. Bita S, Sarhaddipour M. The effects of symbiotic Biomin Imbo supplementation on the antioxidant activities, digestive enzymes and microbial flora of grey mullet, Mugil cephalus intestine. *Aquatic Animals Nutrition*, 2019; 5(1): 111-122. doi: 10.22124/janb.2020.15009.1077
60. Asghari M, Yeganeh S, Hafezieh M. Effects of Nannochloropsis oculata and Isochrysis galbana microalgae added in biofloc system on body composition and sensory evaluation of fillets in Nile tilapia, Oreochromis niloticus. Aquatic Animals Nutrition, 2022; 8(1): 41-56. doi: 10.22124/janb.2023.23646.1180
61. Akbary P. Determination of antioxidant and phytochemical properties of premix extract of brown macroalgae Padinaaustralis, Sargassum licifolium and Stoechospermum marginatum from Chabahar coast, Southeastern Iran. *Aquatic Animals Nutrition*, 2024; 10(1): 27-41. doi: 10.22124/janb.2024.26283.1229

[DOI: 10.61882/pbp.7.4.4]