Ilam University of Medical Sciences

Plant Biotechnology Persa

Online ISSN: 2676-7414

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

Anesthetic Herbs: A Review of the Most Important Anesthetic Medicinal Plants in Traditional Medicine

Ali Akbar Nasiri [1]✉

[1]Department of Anesthesiology, School of Medicine, Imam Khomeini Hospital, Urmia University of Medical Sciences, Urmia, Iran

Article Info

Article type:
Review Article

Article History:
Received: 22 Mar 2025
Revised: 11 May 2025
Accepted: 15 May 2025
Published Online: 20 Sep 2025

✉ ***Correspondence to:***
Ali Akbar Nasiri

Email:
nasiriali7@gmail.com

A B S T R A C T

Objective: Anesthesia plays a vital role in therapeutic and surgical interventions and has held a significant place in traditional medicine as well. Due to their calming effects, greater safety profile, and widespread availability, herbal anesthetics have long attracted interest. Identifying medicinal plants with anesthetic properties in traditional medical texts may open new avenues for research in complementary medicine. This review aims to identify and introduce the most important medicinal plants historically employed for anesthetic purposes in Iranian traditional medicine.

Methodology: To achieve this objective, a comprehensive search was conducted across reputable databases including PubMed, Scopus, Google Scholar, and Web of Science, using keywords such as "medicinal plants," "anesthesia," and "Iranian traditional medicine."

Results: The findings revealed that several plants such as *Papaver rhoeas* L., *Papaver somniferum* L., *Melissa officinalis* L., *Valeriana officinalis* L., *Hyoscyamus niger* L., *Datura stramonium* L., *Syzygium aromaticum* (L.) Merr. & L.M. Perry, *Tilia cordata* Mill., *Nicotiana tabacum* L., *Mentha piperita* L., *Ephedra sinica* Stapf, *Cymbopogon citratus* (DC.) Stapf, *Echinacea purpurea* (L.) Moench, *Allium sativum* L., *Serenoa repens* (Bartram) Small, *Boswellia serrata* Roxb. ex Colebr., *Salix aegyptiaca* L., *Passiflora incarnata* L., *Lavandula angustifolia* Mill., *Matricaria chamomilla* L., *Ocimum basilicum* L., *Echium amoenum* Fisch. & C.A. Mey., *Piper methysticum* G. Forst. have been recognized in traditional Iranian sources as possessing anesthetic properties.

Conclusion: The study demonstrates that a diverse range of medicinal plants have historically been utilized for inducing anesthesia in Iranian traditional medicine. Further investigation into these plants, particularly regarding their mechanisms of action and active constituents, holds promise for the development of safer and more natural anesthetic agents.

Keywords: Anesthesia, Treatment, Medicinal Plants, Traditional Medicine, Iran

➢ **How to cite this paper**
Nasiri AA. Anesthetic Herbs: A Review of the Most Important Anesthetic Medicinal Plants in Traditional Medicine. Plant Biotechnology Persa. 2025; 40-48. DOI: 10.61882/pbp.7.4.6

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

© The Author(s)

DOI: 10.61882/pbp.7.4.6
Publisher: Ilam University of Medical Sciences

Introduction

Anesthesia is one of the fundamental prerequisites for performing many medical and surgical interventions [1]. Its primary aim is to induce a state of analgesia, sedation, or temporary immobility in the patient to facilitate the safe execution of both invasive and non-invasive procedures [2]. Medically, anesthesia is defined as a temporary, controlled state of unconsciousness and insensitivity to pain, typically employed to allow patients to undergo surgical or diagnostic procedures without experiencing discomfort or psychological distress [3, 4]. This condition is generally induced through the administration of specific anesthetic agents that act on the central nervous system, suppressing both sensory and motor functions [5].

Anesthesia encompasses three principal components: analgesia, immobility, and amnesia each essential for ensuring patient safety and comfort during surgical or therapeutic procedures [6]. Depending on the drugs used and the mode of administration—whether inhalational or injectable—anesthetic techniques are typically classified into general anesthesia, regional anesthesia, and local anesthesia [6]. The significance of anesthesia in modern medical advancements cannot be overstated, as it has enabled the performance of increasingly complex and lengthy surgical operations [7]. Nevertheless, the selection of anesthetic agents must be made with great care, taking into account the clinical condition of the patient, the potential side effects of the agents, and their overall efficacy [8].

In recent years, a growing body of research has turned toward the exploration of naturally derived anesthetic agents, particularly those from medicinal plants, as potentially safer alternatives with fewer adverse effects [9]. Although the development of synthetic anesthetics has progressed significantly, their use is still accompanied by concerns such as systemic toxicity, dependency, and elevated risk in vulnerable patient populations [10]. These challenges have prompted renewed interest in identifying safer, plant-based alternatives [10].

Historically, the use of sedative and hypnotic herbs to induce anesthesia or alleviate pain has been well-documented in traditional medical systems worldwide, particularly in Iranian Traditional Medicine (ITM). This valuable corpus of knowledge offers promising insights for the development of novel anesthetic drugs that are both effective and safe [11]. Iranian Traditional Medicine, with its millennia-old heritage, harbors a rich pharmacopeia in which medicinal plants have long been used to promote sedation, induce sleep, and even initiate states of insensibility or anesthesia [12]. Classical medical texts offer substantial evidence of the use of such plants, documenting their names, parts used, preparation methods, and modes of administration [13]. These records can provide crucial guidance for contemporary pharmacological investigations.

Modern clinical and pharmacological studies have confirmed that many traditional medicinal plants contain active compounds—such as alkaloids, flavonoids, saponins, and terpenoids—that can modulate neurological pathways and elicit sedative or anesthetic effects [14]. Plants like Papaver somniferum (opium poppy) and Syzygium aromaticum (clove) have been historically employed to reduce anxiety and promote sleep [15].

Despite this extensive historical background, systematic efforts to identify and compile anesthetic plants specifically referenced in Iranian Traditional Medicine remain scarce [15]. A thorough understanding of their pharmacological capabilities, mechanisms of action, and bioactive constituents could contribute significantly to the development of safer, plant-based anesthetic agents. Moreover, integrating traditional medical knowledge with modern scientific approaches may offer new pathways for advancement in complementary and alternative medicine [16]. Accordingly, the present study aims to provide a comprehensive review of the most important anesthetic medicinal plants cited in authoritative sources of Iranian Traditional Medicine. The findings of this research are intended to lay the groundwork for future preclinical and clinical

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

studies, facilitating the safe and evidence-based incorporation of traditional herbal anesthetics into modern medical practice.

Methodology

This study was conducted as a narrative review with the aim of identifying and introducing medicinal plants with anesthetic properties mentioned in Iranian Traditional Medicine (ITM). The data collection process was based on two primary sources:

Review of Classical Texts and Authoritative References in Iranian Traditional Medicine: In the initial phase, a comprehensive review was conducted of some of the most reputable traditional medical and pharmaceutical sources to identify plants historically used in ITM for their anesthetic or sedative effects. Relevant botanical information, traditional pharmacological characteristics, methods of preparation and administration, and anesthetic-related applications were extracted from both classical texts and reputable online databases.

Inclusion and Exclusion Criteria

The following criteria were used to determine the eligibility of sources for final analysis:

Studies or texts had to specifically address medicinal plants with sedative, hypnotic, or anesthetic effects.

The content had to be directly related to Iranian Traditional Medicine or draw upon recognized sources on Iranian medicinal plants.

Finally, the collected data on each plant— including its scientific name, traditional name, plant part used, pharmacological effects, and traditional applications were systematically organized and presented in categorized tables.

Results

A comprehensive review of authoritative Iranian Traditional Medicine (ITM) sources and an analysis of data extracted from classical texts and scientific databases revealed a wide range of medicinal plants noted for their anesthetic, sedative, and hypnotic properties in traditional literature. Among these, species such as *Papaver rhoeas L., Papaver somniferum L., Melissa officinalis L., Valeriana officinalis L., Hyoscyamus niger L., Datura stramonium L., Syzygium aromaticum (L.) Merr. & L.M. Perry, Tilia cordata Mill., Nicotiana tabacum L., Mentha piperita L., Ephedra sinica Stapf, Cymbopogon citratus (DC.) Stapf, Echinacea purpurea (L.) Moench, Allium sativum L., Serenoa repens (Bartram) Small, Boswellia serrata Roxb. ex Colebr., Salix aegyptiaca L., Passiflora incarnata L., Lavandula angustifolia Mill., Matricaria chamomilla L., Ocimum basilicum L., Echium amoenum Fisch. & C.A. Mey., Piper methysticum* G. Forst. were identified as possessing anesthetic and sedative effects.

According to the gathered data, these plants are cited in various traditional sources not only for their sedative and hypnotic qualities but also, in some cases, for inducing localized anesthesia and alleviating pain prior to medical or surgical procedures. The presence of active compounds such as alkaloids, flavonoids, terpenes, and phenolic constituents plays a crucial role in mediating these effects. Detailed information is provided in Table 1 [15-34].

Table 1. Persian Names, English Names, Scientific Names, Plant Families, Mechanisms of Action, and Key Active Compounds of the Most Prominent Anesthetic Medicinal Plants in Traditional Medicine

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

Row	Persian Name	English Name	Scientific Name	Family	Probable Mechanism of Action	Main Active Compounds
1	Shaqayegh	Corn Poppy	*Papaver rhoeas* L.	Papaveraceae	Hypnotic, sedative, analgesic	Alkaloids, anthocyanins
2	Khoshkhash	Opium Poppy	*Papaver somniferum* L.	Papaveraceae	Opioid receptor inhibition, analgesic, hypnotic	Morphine, codeine, thebaine
3	Badaranjboyeh	Lemon Balm	*Melissa officinalis* L.	Lamiaceae	Effects on GABA receptors, sedative	Rosmarinic acid, flavonoids
4	Sanbal-ol-teeb	Valerian	*Valeriana officinalis* L.	Valerianaceae	Enhances GABA activity in the brain	Valepotriates, valerenic acid
5	Bang-daneh	Henbane	*Hyoscyamus niger* L.	Solanaceae	Acetylcholine inhibition, anticholinergic effects	Hyoscyamine, scopolamine
6	Tatoreh	Jimsonweed / Datura	*Datura stramonium* L.	Solanaceae	Anticholinergic, hypnotic, hallucinogenic effects	Atropine, scopolamine, hyoscyamine
7	Mikhak	Clove	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Myrtaceae	Local anesthetic effect	Eugenol
8	Zirfon	Linden	*Tilia cordata* Mill.	Malvaceae (or Tiliaceae)	Sedative, anxiolytic	Flavonoids, mucilage

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

9	Toton	Tobacco	*Nicotiana tabacum* L.	Solanaceae	Nicotinic receptor activation, sedative and anesthetic effects	Nicotine
10	Nanaa-ye Felfeli	Peppermint	*Mentha piperita* L.	Lamiaceae	Smooth muscle inhibition, mild sedative	Menthol, flavonoids
11	Afdar	Ephedra	*Ephedra sinica* Stapf	Ephedraceae	CNS stimulant and mild anesthetic effects	Ephedrine
12	Alaf Limoo	Lemongrass	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Sedative, anti-stress	Citral, geraniol
13	Sarkhargol	Echinacea	*Echinacea purpurea* (L.) Moench	Asteraceae	Immune system enhancement, sedative	Alkamides, polysaccharides
14	Seer	Garlic	*Allium sativum* L.	Amaryllidaceae	Neuroprotective effects, mild sedative	Allicin, organosulfur compounds
15	Nakhl-e Badabzani	Saw Palmetto	*Serenoa repens* (Bartram) Small	Arecaceae	Anti-androgenic and sedative effects	Phytosterols, fatty acids
16	Kondor	Frankincense	*Boswellia serrata* Roxb. ex Colebr.	Burseraceae	Anti-inflammatory, sedative	Boswellic acids
17	Bidmeshk	Musk Willow	*Salix aegyptiaca* L.	Salicaceae	Sedative, analgesic	Phenolic compounds, flavonoids
18	Gol-e Saati	Passionflower	*Passiflora incarnata* L.	Passifloraceae	Activation of GABA receptors, anxiolytic	Flavonoids, alkaloids

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

19	Ostokhodoos	Lavender	*Lavandula angustifolia* Mill.	Lamiaceae	Sedative, anxiolytic	Linalool, linalyl acetate
20	Babuneh	Chamomile	*Matricaria chamomilla* L.	Asteraceae	Anxiolytic and hypnotic effects	Apigenin, flavonoids
21	Reyhan	Basil	*Ocimum basilicum* L.	Lamiaceae	Mild sedative, anti-stress	Eugenol, linalool
22	Gavzaban-e Irani	Borage	*Echium amoenum* Fisch. & C.A. Mey.	Boraginaceae	Anxiolytic, nerve tonic	Alkaloids, flavonoids
23	Kava	Kava	*Piper methysticum* G. Forst.	Piperaceae	GABA activation, hypnotic, anxiolytic	Kavalactones

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

Figure 1 illustrates a visual summary of the mechanisms of anesthetic herbs.

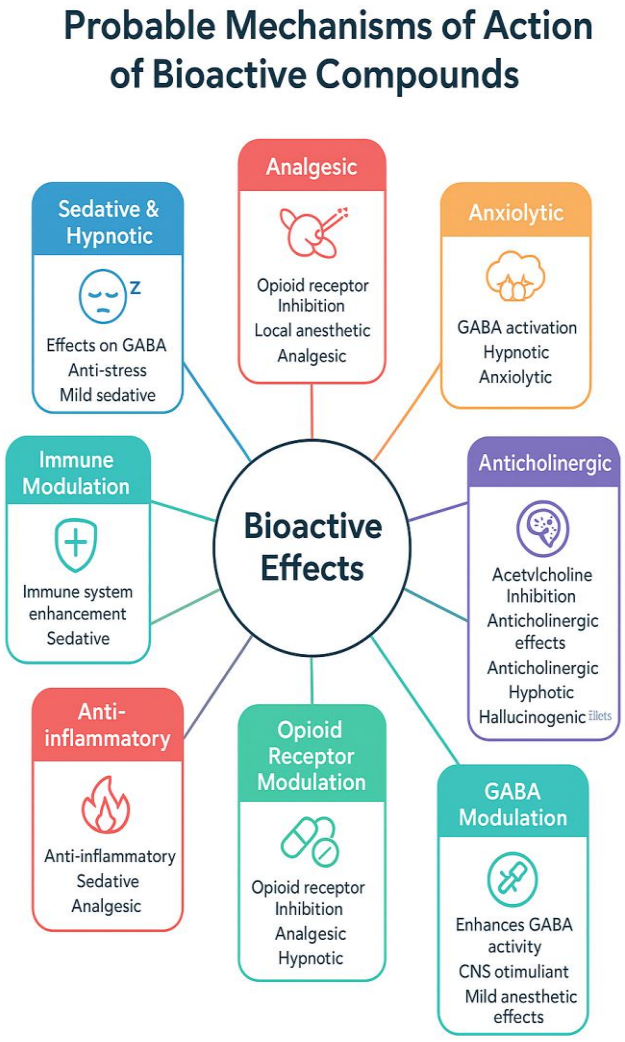


Figure 1: Schematic Overview of the Mechanisms of Anesthetic Herbs

Discussion

Traditional medicine, as a foundational pillar in the history of medical science, has consistently played a pivotal role in pain management and the induction of anesthetic-like states. Ancient Persian medical texts, including the works of Avicenna (Ibn Sina), Rhazes (Al-Razi), as well as Greek and Indian physicians, abound with references to the use of plants possessing sedative, hypnotic, and even anesthetic properties [38]. In an era, devoid of synthetic pharmaceuticals and modern medical apparatus, physicians relied heavily on the medicinal virtues of various herbs to create conditions conducive to performing invasive treatments or early surgical procedures. This wealth of traditional knowledge laid the groundwork for contemporary anesthesia techniques and continues to serve as a vital source of inspiration for the development of novel anesthetic agents that are both safer and more natural in the context of modern medicine [38].

Phytotherapy, a significant branch of complementary medicine, employs extracts, essential oils, or active compounds derived from medicinal plants to treat or alleviate illnesses [39]. Within the realm of anesthesia, phytotherapy occupies a unique position, as certain plants contain bioactive constituents capable of exerting inhibitory effects on the central nervous system, inducing sedation, sleep, or even localized anesthesia. For example, plants such as opium poppy (Papaver somniferum), jimsonweed (Datura stramonium), henbane (Hyoscyamus niger), and valerian (Valeriana officinalis) were traditionally used in Iranian medicine to induce deep sleep and reduce consciousness [39]. Modern pharmacological investigations have revealed that many of these plants harbor compounds that interact with GABAergic, opioid, or cholinergic receptors in the central nervous system, thereby eliciting effects analogous to those produced by contemporary anesthetic drugs [39].

The anesthetic mechanisms of medicinal plants predominantly operate through modulation of neurotransmitters within the central nervous system, particularly the brain and spinal cord [40]. These plants are rich in active substances such as alkaloids, flavonoids, terpenes, and phenols, which can engage with critical neural receptors including GABA_A receptors, opioid receptors, ion channels, and enzymes involved in synaptic transmission [41]. Alkaloids isolated from Papaver somniferum, such as morphine, activate opioid receptors to inhibit pain transmission and induce states resembling anesthesia. Meanwhile, essential oils derived from plants like valerian and lavender exert sedative and hypnotic effects by enhancing GABA receptor activity, thereby reducing neuronal excitability and facilitating relaxation [42]. Naturally occurring anticholinergic compounds in henbane and jimsonweed decrease levels of consciousness and provoke drowsiness by inhibiting acetylcholine neurotransmission at synapses [43]. Other plants, such as clove (Syzygium aromaticum), inhibit sodium channels, producing local anesthetic effects similar to lidocaine [43]. In many diseases and disorders [44-48], turning to nature and embracing traditional or natural therapeutic approaches can serve as a beneficial and complementary strategy helping to alleviate symptoms, support overall well-being, and enhance patients' quality of life [49].

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

Conclusion

In summary, the intricate and diverse mechanisms by which these medicinal plants influence the central nervous system offer considerable potential for the development of natural therapeutics that combine efficacy with fewer side effects than conventional chemical anesthetics. Thorough investigation and precise elucidation of these mechanisms may pave the way for the design of innovative plant-derived pharmaceutical agents in the fields of anesthesia and pain management.

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.

References

1. Nasiri A, Abutorabi SM, Sane S. Intrathecal dexamethasone-bupivacaine combination with bupivacaine alone in spinal anesthesia for cesarean delivery. Caspian J Intern Med. 2024;15(3):414-20. doi:10.22088/cjim.15.3.414.
2. Barash PG, editor. Clinical anesthesia. Philadelphia: Lippincott Williams & Wilkins; 2009.
3. Sane S, Nasiri AA, Bahrami A, Kamalov Z, Hamoud Alshahrani S, Sajid Abdulabbas H, et al. The prophylaxis effect of ephedrine on hemodynamic variation in patients undergoing percutaneous nephrolithotomy surgery with spinal anesthesia. Int J Clin Pract. 2023;2023:8966501. doi:10.1155/2023/8966501.
4. Miller RD, Pardo M. Basics of anesthesia e-book. Philadelphia: Elsevier Health Sciences; 2011.
5. Robinson DH, Toledo AH. Historical development of modern anesthesia. J Investig Surg. 2012;25(3):141-9.
6. Alkire MT, Hudetz AG, Tononi G. Consciousness and anesthesia. Science. 2008;322(5903):876-80.
7. Rahimi M, Golparvar M, Hashemi ST, Nasiri A. The effect of adding magnesium sulfate, neostigmine and fentanyl to ropivacaine on sensory-motor block properties in lower extremity surgery under spinal anesthesia. J Isfahan Med Sch. 2022;40(689):766-74. doi:10.48305/jims.v40.i689.0766.
8. Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, Young WL. Miller's anesthesia e-book. Philadelphia: Elsevier Health Sciences; 2014.
9. Dixon BJ, Dixon JB, Carden JR, Burn AJ, Schachter LM, Playfair JM, et al. General anesthesia. Anesthesiology. 2005;102:1110-5.
10. Atlee JL. Complications in anesthesia e-book. Philadelphia: Elsevier Health Sciences; 2006.
11. Harris M, Chung F. Complications of general anesthesia. Clin Plast Surg. 2013;40(4):503-13.
12. Dimond EG. Acupuncture anesthesia: Western medicine and Chinese traditional medicine. JAMA. 1971;218(10):1558-63.
13. Bajwa SJ, Panda A. Alternative medicine and anesthesia: Implications and considerations in daily practice. AYU. 2012;33(4):475-80.
14. Cheng B, Hung CT, Chiu W. Herbal medicine and anaesthesia. Hong Kong Med J. 2002;8(2):123.
15. Kaye AD, Kucera I, Sabar R. Perioperative anesthesia clinical considerations of alternative medicines. Anesthesiol Clin North Am. 2004;22(1):125-39.
16. Nethathe GD, Russell SL. Traditional medicine use and the anaesthetist. South Afr J Anaesth Analg. 2014;20(6):221-5.
17. Dorman T. Herbal medicine and anesthesia. Curr Opin Anaesthesiol. 2001;14(6):667-9.
18. Ebrahimi SN, Naseri M, Hosseini SA. Iranian traditional medicine and herbal medicine: An overview of the history, principles, and concepts. J Herb Med. 2020;22:100326.
19. Zargari A. Medicinal plants. Tehran: University of Tehran Press; 1992.
20. Ghannadi A. Medicinal plants in Iran: history and perspectives. J Med Plants Res. 2015;9(24):718-26.
21. Mozaffarian V. A dictionary of Iranian plant names. Tehran: Farhang Mo'aser; 1996.
22. Shams-Ardekani MR, Rezaee MB, Yadegar A. Ethnobotanical study of medicinal plants in Iran. J Ethnopharmacol. 2013;146(2):399-410.
23. Keshavarzi Z, Shams-Ardekani MR, Mahmoudian M. Herbal medicine in the treatment of cardiovascular diseases in traditional Iranian medicine. J Tradit Complement Med. 2017;7(4):401-9.
24. Amini A, Ebrahimzadeh MA, Arzi A. Anti-inflammatory effects of medicinal plants used in Iranian traditional medicine: A review. J Complement Integr Med. 2021;18(1):123-34.
25. Malekmohammadi M, Ghanadian M, Naghizadeh M. A review on the most important medicinal plants of Iran in folk medicine. J Nat Remedies. 2018;18(1):10-20.
26. Rezaei M, Saravani R, Shams-Ardekani MR. Pharmacological properties of saffron and its constituents: A review based on traditional Iranian medicine. J Tradit Chin Med. 2019;39(5):777-85.

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]

27. Saeidi M, Rafieian-Kopaei M, Hosseinzadeh H. Ethnopharmacology of medicinal plants in Iran: past and present. J Ethnopharmacol. 2018;210:147-57.
28. Azizi H, Mohagheghzadeh A. Medicinal plants and traditional medicine in Iran. Tehran: Institute of Medicinal Plants; 2017.
29. Abbaszadeh S, Saravani R, Shams-Ardekani MR. Herbal medicines in the treatment of diabetes mellitus in Iranian traditional medicine: A review. J Tradit Complement Med. 2016;6(4):434-43.
30. Hosseinzadeh H, Nassiri-Asl M. Pharmacological effects of Rosa damascena. Iran J Basic Med Sci. 2015;18(3):233-40.
31. Ghaderi S, Shams-Ardekani MR, Jafari SM. Traditional medicinal plants of Iran with anticonvulsant properties: A review. Iran J Pharm Res. 2019;18(1):73-84.
32. Rezazadeh S, Azadi A, Alizadeh H. Herbal plants effective in gastrointestinal diseases: Traditional Iranian medicine perspective. J Herb Med. 2020;21:100310.
33. Mirzaei H, Hosseinzadeh H. A review of traditional Persian medicine and its role in modern drug discovery. J Tradit Complement Med. 2019;9(2):91-102.
34. Ghorbani A. Review of medicinal plants used in Iranian traditional medicine for respiratory diseases. J Ethnopharmacol. 2021;270:113802.
35. Emami SA, Mohammadi H, Asgarpanah J. Chemical composition and pharmacological effects of Matricaria chamomilla: An overview. J Pharm Pharmacol. 2017;69(6):701-12.
36. Sadraei H, Asghari G, Emami SA. Medicinal plants of Iran effective on nervous system disorders. Iran J Pharm Res. 2016;15(3):459-67.
37. Zarshenas MM, Moein M, Petramfar P. A review on traditional Iranian medicinal plants effective on anxiety and depression. J Tradit Chin Med. 2018;38(4):510-21.
38. Zhang W, Zhang M, Han Y, Liu Y, Liu Y, Sun C. Combined acupuncture-medicine anesthesia used in thyroid surgery: A systematic review and meta-analysis. Medicine (Baltimore). 2023;102(1):e32582.
39. Duygun H, Epözdemir S. Phytotherapy and pain management. J Comple Alter Med Res. 2023;1(4).
40. Hansen SB. Mechanisms of general anesthesia. Annu Rev Biochem. 2025;94.
41. Chandrika UG, Karunarathna U. Anesthetics and analgesic activities of herbal medicine: review of the possible mechanism of action. Features Assess Pain Anaesth Analg. 2022;1:47-56.
42. Yousofvand N, Moloodi B. An overview of the effect of medicinal herbs on pain. Phytother Res. 2023;37(3):1057-81.
43. Haro-González JN, Castillo-Herrera GA, Martínez-Velázquez M, Espinosa-Andrews H. Clove essential oil (Syzygium aromaticum L. Myrtaceae): Extraction, chemical composition, food applications, and essential bioactivity for human health. Molecules. 2021;26(21):6387. doi:10.3390/molecules26216387.
44. 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.
45. 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.
46. 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.
47. 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.
48. Darvishi M, Noori M, Nazer MR, Soleiman-Meigooni S, Forootan M. The relationship between Helicobacter pylori and extra-gastrointestinal infections. Iran J Med Microbiol. 2020 Nov 10;14(6):543–565.
49. 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

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61882/pbp.7.4.6]