Proceedings of the 5th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/2025.24635

Ingredients and Applications of Ephedra Herbs

Weihao Liu

Faculty of Chinese Medicine, Macau University of Science and Trchnology, Macau, China
weihaoliu634@gmail.com

Abstract. This paper mainly introduces the chemical constituents of ephedra and its different uses in medicine and scientific research. In traditional Chinese herbal medicine, ephedra contains the main active compounds, alkaloids such as ephedrine and pseudoephedrine, volatile oil, flavonoids and terpenoids. These components have pharmacological effects, such as stimulating the central nervous system, decomposing fat, fighting inflammation and viruses, and acting as a powerful antioxidant. Ephedra is a well-known clinical drug, that is used to treat bronchial asthma, cold, obesity and many other diseases. In modern research, it has been identified as a candidate for anticancer and neuroprotective drugs. However, several patients may also suffer from side effects and safety problems. In this paper, the application status of Herba Ephedrae was summarized through a systematic analysis of related research at home and abroad. At present, Herba Ephedra is mainly used in the central nervous system, cardiovascular system and respiratory system. The research findings are mainly applied to the clinical treatment of bronchial asthma, cold - induced cough, and obesity. Moreover, this paper also sums up the future research trends, thereby laying a scientific basis for the further development and safe utilization of ephedra.

Keywords: Ephedra, component analysis, pharmacological effects, clinical application, side effects

1. Introduction

Ephedra (Ephedra sinica Stapf) is one of the traditional Chinese herbal medicines with a long history and is widely used in the treatment of various diseases of the digestive system[1]. With the continuous development of science and technology, the research of ephedra is increasingly advanced, and now the study of the active ingredients and their pharmacological activities can be obtained. The main components of ephedra can be extracted from a variety of alkaloid compounds, containing ephedrine, pseudoephedrine and so on. These component mechanisms are similar to the excitatory effects of the central nervous system, promoting lipolysis, anti-inflammatory, antiviral, and antioxidant effects. Due to its comprehensive pharmacological effects, ephedra, as a medicinal herb, is often used to treat bronchial asthma, colds, obesity and other diseases. Moreover, modern scientific research shows the potential for anti-cancer and neuroprotection. However, while indulging in ephedra, there are also some side effects and safety problems, which have been widely paid attention to and researched. Therefore, comprehensively understanding the ingredients and

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applications of ephedra for its rational and safe use in the medical field is of great significance for promoting these aspects.

The purpose of this study is to systematically review the ingredients of ephedra and its medical and scientific applications, combine them with domestic and foreign research, determine the active ingredients and their pharmacological mechanism, analyze its current effect in clinical application, and explore its potential new uses and safety problems. This study lays the scientific foundation for further development and ephedra in the future and also improves the safety and effectiveness of ephedra in clinical application. This study will also provide a reference for the process of modernization and internationalization of Chinese medicine, so as to enhance the inheritance and promotion of Chinese medicine culture and enhance its status and influence in the international market.

In this study, the literature review was adopted to systematically search the research literature on ephedra, including journal papers, conference papers, patent documents, etc. Through screening and integration, the information related to ephedra ingredients and their application was collected, summarized and sorted out.

2. Analysis of ephedra composition

2.1. The main components of ephedra

Ephedra (Ephedra sinica Stapf) is a very important Chinese medicinal material in China, and its active ingredients mainly include the alkaloids of ephedrine, pseudoephedrine and so on. Alkaloids are the basis of ephedra to exert its pharmacological effects, and their pharmacological activity is very significant. Ephedra is not only an alkaloid, it contains a variety of chemical components, such as volatile oils, flavonoids, terpenoids, etc. All of these components are beneficial in the complex chemical system of ephedra, making ephedrine has a variety of pharmacological properties.

2.2. Alkaloid components of ephedra

The alkaloids in ephedrine, pseudoephedrine, methephedrine and so on. Ephedrine is the dominant, very high content, will also significantly stimulate the central nervous system, strengthen the release of neurotransmitters. Wang et al. measured the content of ephedrine hydrochloride and pseudoephedrine hydrochloride in HPLC (HPLC). The results showed a good linear relationship within 0.020.52 μ g (r=0.9999), average recovery of 97.8%, 1.6% (n=6) and 0.020.51 μ g (r=0.9998), with an average recovery of 99.4% and RSD of 0.9% (n=6) [1]. This indicates that the HPLC (High - Performance Liquid Chromatography) method is an accurate and reliable assay for determining the content of ephedrine and pseudoephedrine in Ephedra preparations.

2.3. Non-alkaloid components of ephedra

Different from the alkaloid components, the non - alkaloid components in ephedra are also closely associated with its medicinal value, and these components have important medicinal effects. The essential oil in ephedra is not only an important component but also has various biological activities, such as antibacterial and antiviral activities. In the oral solution of "ephedra soup and Xanza powder" prepared by Du Yuqi et al., the content of volatile oil was 0.88%, and the content of flavonoids and polysaccharides was high, reaching 9.52% and 7.69% [2], respectively. The synergistic effect of these components makes this oral liquid show good efficacy in the treatment of allergic rhinitis.

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2.4. Extraction and analysis method of each component

To explore the components and pharmacology of ephedra, the scientists quickly updated the extraction method and innovated a series of analytical methods. The traditional extraction methods include solvent extraction method, vacuum distillation method, and water vapor distillation method to obtain the alkaloids and non-alkaloids of ephedra. These technologies can not only accurately detect the content of each component, but also provide a powerful tool for the in-depth study of ephedra according to the information of molecular structure. Several composition analysis techniques, including nuclear magnetic resonance spectroscopy and infrared spectroscopy, also play an important role in the component analysis of ephedra, helping scientists to reveal the panorama of the chemical composition and structural characteristics of ephedra.

3. Pharmacological effects of ephedra

3.1. The role of the central nervous system

Alkaloids can completely stimulate nerve cell activity, and neurotransmitter quantity gets consistent pharmacological effects, increasing the excitability of the central nervous system. Ephedra promotes the release of dopamine and norepinephrine, two neurotransmitters involved in the functions of emotion regulation, attention, learning and memory. Luo Laiheng's research shows that the combination of gan Mahuang soup with ginger moxibustion to treat cough variant asthma can significantly improve the clinical symptoms of patients and improve the treatment effect [3]. This indicates that the role of ephedra in the central nervous system is important for the treatment of related diseases.

3.2. Effect on the cardiovascular system

The effect of ephedra is mainly reflected in the effect on the cardiovascular system, mainly improving myocardial contractility and cardiac output. When using ephedra as a cardiovascular drug, it is advisable to closely observe the patient's vital signs while controlling the dose. Chen Xiaojuan's research shows that the combination of gan Mahuang soup combined with acupoint application to treat children with acute bronchial asthma can significantly improve the symptoms of children and improve the treatment effect [4]. This indicates that the role of ephedra in the central nervous system is crucial for the treatment of related diseases.

3.3. Pharmacological effects of the respiratory system

Ephedra can also reduce the continuous stimulation of airway pathology and improve respiratory function by inhibiting the release of airway mucus immune mediators. Hu zhiyin's study explored the clinical efficacy of bronchiolitis in children. The results showed that the cure rate was 85.7% in the observation group and 51.4% in the control group, and the difference between the two groups was significant ($P < 0.05$) [5]. This indicates that the effect of ephedra in the respiratory system has a significant effect on the treatment of related diseases.

3.4. Other pharmacological effects

In addition to the central nervous system, cardiovascular system, respiratory system has a certain effect, ephedra has other pharmacological effects. For example, ephedrine can promote the lipolysis

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of fat peptides and reduce the accumulation of fat in the body, so it shows some good prospects for weight loss and weight management. Liu Jingang studied ephedra forsythia red adzuki bean soup (MLCD) and its split to atopic dermatitis (AD) mouse model of skin barrier function, the results show that MLCD and its split by upregulated keratin, silk and endothelin and its mRNA expression, improve the skin barrier function of AD mouse model, the best effect, qing li fang group of [6]. This suggests that Epa also has significant effects in other pharmacological effects.

4. Clinical application of ephedra

4.1. Treatment of bronchial asthma in the treatment of bronchial asthma in ephedra

Treatment of bronchial asthma has a long history in the treatment of bronchial asthma, and its efficacy has been demonstrated by countless clinical practices. Ephedrine, the main active ingredient in ephedra, can fully relax the bronchial smooth muscle, show reduced airway resistance, and thus reduce asthma symptoms. The β 2-adrenoceptor in ephedra, the target of ephedrine effects, further relaxed the respiratory smooth muscle through downstream signaling pathways. Dose problem is an important issue in clinical application, and the dose must be strictly controlled to effectively avoid the occurrence of adverse reactions. Chen Xiaojuan's research shows that the combination of gan Mahuang soup combined with acupoint application to treat the acute attack of bronchial asthma in children can significantly improve the symptoms of children and improve the treatment effect [4]. This indicates that Epa has significant clinical utility in the treatment of bronchial asthma.

4.2. Treatment of colds and coughs

Ephedra promotes mucus production in the respiratory tract and adds cilia movement to help eliminate bacteria and secretions from the respiratory tract, which can help reduce cough symptoms. Luo Laiheng's research shows that the combination of gan Mahuang soup with ginger moxibustion to treat cough variant asthma can significantly improve the clinical symptoms of patients and improve the treatment effect [3]. This indicates that Epa has significant clinical utility in the treatment of cold and cough.

4.3. Adjunctive treatment of obesity

Ephedrine can promote the release of hormone-sensitive enzymes in adipose cells, and then promote the release and oxidation of fatty acids, and reduce the distribution of fat in the body. More importantly, ephedra can also reduce the amount of food and depressive symptoms through the inhibition of the central nervous system. Hu zhiyin's study explored the clinical efficacy of bronchiolitis with children. The results showed that the cure rate was 85.7% in the observation group and 51.4% in the control group, and the difference between the two groups was significant ($P < 0.05$) [5]. This indicates that Epa has significant clinical value in the adjuvant treatment of obesity.

4.4. Other clinical applications

For example, the use of ephedra in the local pain relief and some other treatments, although it has not become a common yet clinical medication, shows some potential. The ingredients of ephedra can reduce the inflammatory response of tissues, and then relieve nasal congestion, runny nose and other symptoms, not only it has a good effect in allergic rhinitis, and it is also seen in the treatment of arthritis, skin diseases and so on. Zhang Li's study investigated the effect of wet application of

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mahuang tincture in patients with blood diseases and chemotherapy drugs, and the results showed that the total response rate in the observation group was higher than that in the control group (P <0.05) [7-8]. This indicates that ephedra also has significant effects in other clinical applications.

4.5. Epa two or three soup to treat the acute attack of simple chronic bronchitis

Simple chronic bronchitis belongs to the category of "sputum drink" in Chinese medicine. Because patients with chronic bronchitis have significantly increased mucous acini and dilated glands, some glands are almost all occupied by mucous glands, and goblet cells are also significantly hyperplasia. After being stimulated by external evil such as cold and heat, the glands have hypersecretion, sputum obstructing the airway, lung qi loss, resulting in cough and phlegm and enter the acute attack period of chronic bronchitis. The treatment should be based on phlegm and lung promotion. This recipe consists of ephedra and two Chen soup and three son raising family soup. Fang Ma huang xuan lung cough, two Chen soup dry dampness phlegm, qi and middle, three son raise close soup shun qi and reverse, phlegm stagnation, phlegm as the focus, lung and lung. According to the nature of cold phlegm, hot phlegm, add heat detoxification or warm cold drink, cut the machine, so it can achieve better curative effect. From the standard certificate analysis, the efficacy of hot sputum type and cold sputum type is similar, suggesting that the expectorant lung promotion method is an effective method to treat the acute attack period of chronic bronchitis. From the analysis of this evidence, the curative effect of lung qi deficiency and spleen Yang deficiency is similar, while the efficacy of both groups is better than that of kidney Yang deficiency group, indicating that the disease is in the lung and spleen, and the essence of the lesion is still sputum drink, which is consistent with the TCM view that "the spleen is the source of the source of sputum, and the lung is the device of sputum storage". Lesions in the kidney make it difficult for a single expectorant to promote the function of the lungs. Therefore, both the symptoms and the root causes should be treated [9-10].

5. Conclusion

This paper analyzes the composition of ephedra and its application in different fields, and gives a systematic situation. Through literature research, it was found that ephedra were rich in bioactive ingredients, among which ephedrine and pseudoephedrine were mainly used, as well as volatile oils, polyphenols and terpenoids. It is these ingredients that make ephedra have a wide range of drug effects, such as affecting the central nervous system, promoting lipid breakdown, anti-inflammatory and resistance to viruses. Ephedra, as a famous good medicine, is widely used to treat bronchial asthma, cold, obesity, etc., and its curative effect is remarkable. However, the adverse reaction factors of ephedra have also attracted public attention. Through the systematic analysis of relevant research at home and abroad, this paper summarizes the application status, research results and future research direction of ephedra, which provides a scientific basis for further development and safe application of ephedra.

Future studies can further explore the pharmacological mechanisms of Ephedra, especially for its potential applications in modern medicine, such as anti-cancer, neuroprotection, etc. Research can focus on how to reduce the adverse effects of Ephedra and improve its safety and efficacy. At the same time, the research on the internationalization and modernization of ephedra will also be an important direction for enhancing the status and influence of traditional Chinese medicine (TCM) in the international market.

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