Dandelion Application Practices and Pharmacological Action Research Progress

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Abstract: Dandelion is a medicinal and edible plant with both culinary and medicinal value, widely used in traditional and modern medicine. The entire dandelion plant can be used for medicinal purposes, offering effects such as heat-clearing, detoxifying, reducing swelling and dissipating nodules, and diuretic functions. It is suitable for the treatment of various diseases, including heat-toxicity, mastitis, lung abscess, and intestinal abscess, with significant therapeutic effects. Dandelion contains various active compounds, including flavonoids, terpenes, and polysaccharides, which confer pharmacological activities such as anti-inflammatory, antioxidant, and antimicrobial properties. These activities show great promise for clinical applications. This paper reviews literature on dandelion, summarizing its practical applications and analyzing its pharmacological effects, aiming to provide insights for further research and development.
***Keywords*:** Dandelion; pharmacological effects; heat-clearing and detoxifying; antioxidant activity

1. Introduction

Dandelion is widely distributed in many countries and regions around the world, and occupies a unique position in botanical classification. For a long time, it has played an important role in natural ecosystems due to its multiple characteristics, and has also shown significant value in human production and daily life. Traditional Chinese medicine texts have long recorded its medicinal value. Classic works such as Compendium of Materia Medica and Newly Revised Materia Medica mention that dandelion has the functions of reducing swelling and dissipating nodules, promoting diuresis, and relieving dysuria. It has distinct advantages in treating diseases like mastitis, lung abscess, and intestinal abscess[1]. Over a long period of practical accumulation, rich medicinal experiences with dandelion have been developed in folk medicine, laying the foundation for its application in traditional medicine. With the development of medical science and technology, significant breakthroughs have been made in the research of dandelion. Modern medical research shows that dandelion is rich in various bioactive components such as flavonoids, terpenes, and polysaccharides, which exhibit anti-inflammatory, antioxidant, and antibacterial pharmacological activities[2], providing scientific evidence for its application in modern medicine. This study systematically reviews the research status of dandelion, focusing on its active components, practical applications, and pharmacological effects.

2. Active Components of Dandelion

Dandelion shows high application potential in fields such as medicine, food, and cosmetics, which is closely related to its rich active components. The main active components of dandelion are as follows:

(1) Flavonoids. These include luteolin, quercetin, kaempferol, etc. The above flavonoids have a typical C6-C3-C6 carbon backbone structure and exhibit antioxidant abilities. Studies have shown that flavonoids can remove excessive free radicals in the body due to their chemical properties[3]. The accumulation of free radicals can lead to oxidative stress and cell damage, while flavonoids can effectively inhibit this process, preventing oxidative stress from damaging cells and thereby preventing or alleviating diseases related to oxidative stress, such as hypertension, coronary heart disease, and cancer. The distribution and content of flavonoids vary in different parts of dandelion, with higher concentrations typically found in the flowers and leaves.

(2) Terpenoids. Sesquiterpene lactones have a unique lactone ring structure, strong biological activity, and both anti-tumor and immune-regulating effects. Sesquiterpene lactones can exert antibacterial effects by inhibiting the synthesis of bacterial cell walls or destroying bacterial cell membranes. In addition, they can induce apoptosis of tumor cells, inhibit the proliferation and metastasis of tumor cells. Furthermore, dandelion contains triterpenoids, such as dandelion sterols, which help regulate blood lipids, have anti-inflammatory effects, and protect the liver, playing an important role in maintaining human health.

(3) Polysaccharides. Dandelion polysaccharides have immune-regulating effects, enhancing the body's immune

functions and increasing its resistance to pathogens. In addition, dandelion polysaccharides possess antioxidant, blood sugar-lowering, and blood lipid-lowering activities. In terms of antioxidant effects, dandelion polysaccharides can enhance the activity of the body's antioxidant enzymes, remove free radicals, and reduce oxidative damage. In terms of lowering blood sugar and blood lipids, dandelion polysaccharides can regulate the activity of enzymes related to sugar and lipid metabolism, promoting the metabolism and utilization of sugars and lipids.

In addition to the above active components, dandelion also contains phenolic acids and essential oils. The former mainly serves antioxidant, anti-inflammatory, and antibacterial purposes, while the latter helps strengthen kidney filtration.

3. Clinical Application of Dandelion

3.1 Digestive System Disorders

Helicobacter pylori (Hp) infection is one of the major causes of chronic gastritis, peptic ulcers, and other digestive system diseases. Studies have shown that dandelion has significant anti-Hp effects, and its active components can inhibit the growth and reproduction of Hp, thereby reducing gastric mucosal inflammation and promoting ulcer healing[4]. Chen Shuping et al.[5] conducted a study on 120 patients with Hp-related gastritis of the spleen and stomach damp-heat type. The patients were randomly divided into a control group and a treatment group, receiving a quadruple therapy regimen and combined dandelion treatment, respectively. The results showed that the total effective rate in the treatment group was 95.00%, and the Hp eradication rate was 96.67%, both higher than those in the control group. Additionally, the Traditional Chinese Medicine symptom scores improved significantly in the treatment group compared to the control group, demonstrating the advantages of dandelion in the treatment of chronic gastritis. Furthermore, dandelion can regulate gastrointestinal motility and promote the recovery of digestive functions. Its active components act on the smooth muscles of the gastrointestinal tract, increasing the frequency and amplitude of peristalsis, thus promoting digestion and gastric emptying. For patients with functional dyspepsia, dandelion can improve digestion and alleviate symptoms by adjusting gastrointestinal motility. In clinical practice, dandelion is often combined with other herbs such as Atractylodes, Poria, and Dried Tangerine Peel, which strengthen the spleen and stomach, regulate qi, and reduce bloating, to enhance the therapeutic effects.

3.2 Gynecological Disorders

Mastopathy is a common benign breast disease in women, closely related to endocrine disorders, emotional stress, and other factors. Traditional Chinese Medicine (TCM) holds that the main pathogenesis of mastopathy is liver qi stagnation and blood stasis. Dandelion can clear liver heat, relieve liver qi stagnation, and reduce swelling, making it effective in the treatment of mastopathy[6]. Pelvic inflammatory disease is an inflammation of the female internal reproductive organs and surrounding connective tissues, often manifesting as lower abdominal pain, distention, and abnormal vaginal discharge. TCM attributes pelvic inflammatory disease to damp-heat descending and stagnation of qi and blood. Dandelion, with its heat-clearing, detoxifying, diuretic, and promoting urination properties, can clear damp-heat in the lower abdomen, reduce inflammation, and promote the expulsion of pathogenic damp-heat. Mastitis is a common condition in breastfeeding women, severely affecting both maternal health and breastfeeding. TCM believes that mastitis is caused by liver qi stagnation, stomach heat, and milk stasis. Dandelion has heat-clearing, detoxifying, anti-swelling, and lactation-promoting effects, making it a commonly used medicine in the treatment of mastitis. Zhang Jingjin et al.[7] conducted a study on breastfeeding women with mastitis and abscesses, using drainage combined with dandelion decoction treatment. The total effective rate was higher than that of the control group, with significant reductions in breast lumps and pain, demonstrating the therapeutic advantages of dandelion.

3.3 Urinary System Disorders

Dandelion has broad applications in the treatment of urinary system disorders, with notable efficacy. In urinary tract infections, dandelion extracts show strong inhibitory effects on common urinary tract pathogens such as Escherichia coli and Staphylococcus aureus. Clinically, dandelion is often used in combination with antibiotics, yielding remarkable therapeutic effects. Dandelion extracts can also inhibit the formation of calcium oxalate crystals, reducing the risk of urinary stone formation. In clinical practice, for patients with smaller stones, dandelion is often combined with other stone-dissolving herbs such as Oldenlandia and Lysimachia, promoting stone expulsion. Dandelion's diuretic action helps flush the urinary tract, facilitating stone passage, while its ability to inhibit crystal formation prevents the enlargement of stones and the formation of new ones. Additionally, in the treatment of chronic prostatitis, Pu Zhaohé[8] proposed a prescription using dandelion decoction, composed of 45g dandelion, 15g Plantago asiatica, 20g Salvia miltiorrhiza, and 6g licorice. This prescription combines the heat-clearing and detoxifying properties of dandelion with the diuretic and antibacterial effects of

the other herbs, working together to clear heat, detoxify, promote urination, remove turbidity, and activate blood circulation.

3.4 Respiratory System Disorders

In the treatment of acute tonsillitis, dandelion has heat-clearing, detoxifying, anti-swelling, and throat-relieving effects. Clinically, dandelion oral liquid is often used in conjunction with conventional western medicines. Yan Zhuo[9] studied 197 patients with acute tonsillitis, dividing them into a control group and a treatment group. The treatment group received dandelion granules in addition to western medicine, and the results showed that the treatment group had a shorter symptom improvement time and significantly better quality of life compared to the control group. This effect is related to dandelion's ability to suppress the release of inflammatory mediators, reducing inflammation and thereby alleviating sore throat and fever. The volatile oils and flavonoids in dandelion can dilate the bronchial tubes and lungs, facilitate breathing, alleviate coughing and dyspnea, and inhibit bacterial and viral growth, assisting in the treatment of upper respiratory tract infections. Additionally, dandelion's heat-clearing and detoxifying properties help eliminate internal heat toxins and relieve fever symptoms. In traditional TCM practice, dandelion is often combined with other herbs that expel pathogens from the exterior to enhance therapeutic effects.

3.5 Dermatological Disorders

Dandelion possesses heat-clearing, detoxifying, and anti-swelling properties, making it effective in treating skin diseases caused by heat toxins or damp-heat. In the treatment of acne, dandelion reduces sebum secretion from sebaceous glands, effectively inhibiting Propionibacterium acnes, and alleviating inflammation. It is often used in combination with other heat-clearing and detoxifying herbs such as Honeysuckle and Wild Chrysanthemum, in the form of internal decoctions or topical washes to help improve acne symptoms. In the treatment of eczema, dandelion's unique heat-clearing, detoxifying, antibacterial, and anti-inflammatory properties can reduce inflammation, alleviate itching, regulate immunity, and reduce the frequency and severity of flare-ups. It can be crushed and applied topically, or decocted and used to wash the affected areas several times a day. Dandelion is also used in the treatment of psoriasis, where its flavonoid content helps inhibit excessive growth of epidermal cells, assisting in symptom relief. It is commonly used in the form of dandelion leaf tea or crushed fresh dandelion for topical application, achieving both internal and external therapeutic effects.

4. Pharmacological Effects of Dandelion

4.1 Antibacterial Effect

Dandelion, as a natural antibacterial agent, has a significant inhibitory effect on various bacteria. The compounds present in dandelion, such as taraxasterol and flavonoids, play a key role in its antibacterial activity. Studies have shown that in vitro, dandelion demonstrates notable bactericidal activity against antibiotic-resistant strains of Staphylococcus aureus, effectively inhibiting and killing these bacteria [10]. Additionally, dandelion injection exhibits good bactericidal effects against various bacteria, including Streptococcus pneumoniae, Neisseria meningitidis, and Pseudomonas aeruginosa. The antibacterial mechanism is primarily through the disruption of bacterial cell walls and membranes, interfering with bacterial metabolism, thereby inhibiting their growth and reproduction.

4.2 Anti-inflammatory Effect

Dandelion can suppress the release of various inflammatory mediators and alleviate inflammation. It reduces the production of inflammatory factors by inhibiting the NF-κB signaling pathway, thereby mitigating inflammation. When the body faces an inflammatory attack, dandelion can regulate the immune response, suppress the activation of inflammatory cells, and the release of inflammatory mediators, reducing symptoms such as redness, swelling, heat, and pain. In animal experiments, the use of dandelion extract significantly reduced swelling at the inflammation site and decreased inflammatory markers.

4.3 Hepatoprotective and Cholagogic Effects

Dandelion protects liver cells, increases glycogen content, and maintains liver health. Oral administration of dandelion decoction or injection can significantly inhibit the increase in serum alanine aminotransferase (ALT) levels induced by carbon tetrachloride, alleviating histological changes caused by carbon tetrachloride-induced liver injury. Dandelion extract administered orally can cause gallbladder contraction and relaxation of the Oddi sphincter, facilitating the flow of bile into the intestines, which is clinically effective in treating chronic gallbladder spasms and gallstones. This is due to compounds in dandelion, such as choline, bile acids, and lecithin, which promote bile secretion and excretion, reduce liver burden, and protect liver function.

4.4 Antioxidant Effect

Dandelion is rich in flavonoids, phenolic acids, and other components, giving it strong antioxidant capabilities. In DPPH radical scavenging and iron ion reduction/antioxidant tests, dandelion extracts exhibited strong antioxidant activity, indicating its ability to scavenge free radicals and inhibit lipid peroxidation. These antioxidant components neutralize excessive free radicals in the body, reduce oxidative stress-induced damage to cells, and help prevent and alleviate diseases associated with oxidative stress, as well as delay aging.

4.5 Immunomodulatory Effect

Dandelion decoction significantly increases the transformation rate of human peripheral blood lymphocytes in vitro. Dandelion polysaccharides can significantly enhance the delayed-type hypersensitivity response induced by the Ehrlich ascites carcinoma and MM46 tumor cell antigens in mice. By modulating the activity of immune cells in the body, dandelion enhances the immune function and improves the body's resistance to pathogens.

5. Conclusion

In conclusion, dandelion is rich in effective components and plays an important role in the treatment of various conditions, from the digestive system to dermatology. It can effectively alleviate symptoms and improve therapeutic outcomes for patients. Its pharmacological effects cover multiple aspects, including antibacterial, anti-inflammatory, and hepatoprotective effects, providing a strong theoretical basis for clinical treatment. In the future, further research is needed to explore its mechanisms of action, develop more efficient and safe dandelion preparations, and promote its widespread application in the medical field.

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