

Advantages and Application Prospects of Traditional Chinese Medicine Granules

Xiaohua Sun*

Nanjing Xingyin Pharmaceutical Group Co., Ltd., Nanjing 210000, Jiangsu Province, China

*Corresponding author: Xiaohua Sun, 478512346@qq.com

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Abstract: With the advancement of the modernization of traditional Chinese medicine (TCM), TCM granules have emerged and garnered widespread attention. This study provides a comprehensive review of the development of TCM granules, analyzing their characteristics in terms of ease of use, quality stability, and pharmacodynamic advantages. It also explores their broad application prospects in clinical TCM treatment and preventive healthcare. Through an integrative analysis of relevant research literature, the study highlights the significant value and vast development potential of TCM granules in modern medicine. The article aims to offer valuable references for the modernization and internationalization of TCM while promoting the continuous development and innovative application of TCM granules in the field of traditional Chinese medicine.

Keywords: TCM granules; Advantages; Clinical application; Preventive healthcare

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1. Introduction

Throughout the long history of traditional Chinese medicine (TCM) development, drug formulations have continually evolved and innovated to meet the demands of modern society and medical practices. As a novel TCM formulation, TCM granules have emerged based on traditional decoctions, integrating the essence of TCM theories with modern pharmaceutical technologies. They are gradually gaining prominence in clinical TCM treatment, the modernization of TCM, and public health care. TCM granules retain the characteristics and efficacy of TCM compound formulas while offering numerous advantages, including convenience, quality stability, and ease of storage and transport^[1]. These features make TCM granules a prominent research and application focus in the field of TCM, paving new paths for its inheritance and development. They also provide patients with safer, more efficient, and more convenient medication options, showcasing broad application prospects and significant research value.

2. Development history of traditional Chinese medicine granules

The development of TCM granules can be traced back to the mid-20th century. Early preparation methods were relatively simple due to technological limitations, often involving the direct granulation of crushed TCM decoction pieces. This approach resulted in incomplete extraction of active ingredients and inconsistent granule quality [2]. With rapid advancements in science and technology, modern pharmaceutical techniques began to be applied to TCM granules in the 1970s. For example, in extraction technology, supercritical fluid extraction was introduced to extract active components, such as tanshinones from *Salvia miltiorrhiza* and ligustilide and total lactones from *Ligusticum chuansiong*, which demonstrated enhanced efficacy in preventing cardiovascular and cerebrovascular diseases [3].

Drying technologies, such as spray drying and vacuum freeze-drying, have significantly improved the granules' formability and stability [4]. Granulation techniques have also evolved, with innovations such as fluidized bed granulation and dry granulation enabling more efficient and precise production processes. Entering the 21st century, advanced quality control methods, including TCM fingerprint technology and multi-component quantitative analysis, have been widely applied in the field of TCM granules. These methods effectively ensure product consistency and controllability [5].

3. Advantages of traditional Chinese medicine granules

3.1. Convenience in consumption

The preparation of traditional decoctions is laborious, requiring patients to spend significant time and effort in boiling herbs, with conditions such as heat, time, and water volume being difficult to control precisely, often leading to variations in efficacy. In contrast, TCM granules can be dissolved and consumed instantly, thanks to modern packaging technologies such as individual sachets or bottled designs. Patients only need to pour the granules into a cup and add a suitable amount of hot or warm water, and the medicine dissolves quickly, eliminating the need for the complicated decoction process and saving both time and effort. For example, in a study by Xu [6], patients using TCM granules found them more convenient to take compared to decoctions.

Additionally, during production, TCM granules benefit from precise weighing systems and automated packaging equipment, ensuring accurate dosing in each sachet or granule. This eliminates concerns of under-dosage or over-dosage during use, a problem often associated with pills or powders, especially for children and the elderly. The application of modern packaging technologies enables clear, pre-measured doses, which can be tailored to individual patient needs without worry of incorrect dosage [7].

Furthermore, pills are often hard-textured and difficult for some patients to swallow, while powders may have an unpleasant taste and can cause choking. TCM granules dissolve well and typically include flavor enhancers or sweeteners, improving patient compliance and therapeutic outcomes [8].

3.2. Quality stability

TCM granules ensure strict control over raw material quality. During procurement, factors such as the origin and harvest season are prioritized, with high-quality, authentic medicinal materials being preferred to ensure stable active ingredient content. For instance, Sanqi from Wenshan, Yunnan, and Zhe Beimu from Pan'an, Zhejiang, are widely used in granule production. Moreover, the preparation of raw herbs follows standardized management practices, combining traditional processing techniques with modern quality standards to reduce toxicity and

enhance pharmacological stability^[9].

During production, modern equipment and automated production lines enable precise control over every stage of the process. For example, in the extraction process, computer-controlled systems accurately regulate parameters such as temperature, pressure, and time to ensure efficient extraction without damaging active ingredients. In the case of Huangqin granules, optimal extraction conditions involve two water extractions: the first with 13 times the water volume, boiled for 1 hour, and the second with 11 times the water volume, also boiled for 1 hour^[10].

Production environments and process quality control strictly adhere to Good Manufacturing Practices (GMP) standards, effectively preventing microbial and cross-contamination. Advanced equipment such as vacuum concentrators and spray dryers efficiently extract and concentrate active components into granule form, minimizing losses during processing and ensuring the stability and consistency of active ingredients^[11]. Additionally, modern detection equipment, such as microbial limit detectors and heavy metal analyzers, performs comprehensive quality testing on finished products, further ensuring the stability and safety of TCM granules.

3.3. Pharmacodynamic advantages

Modern TCM granule preparation technologies efficiently extract and retain active ingredients from herbs. For example, Wang *et al.*^[12] found that ultrasound-assisted extraction of puerarin from *Pueraria lobata* achieved a 95.85% extraction rate, significantly higher than the 86.2% rate from ethanol reflux methods. For heat-sensitive or volatile components, such as menthol in Mint or volatile oils in Schizonepeta, low-temperature extraction, freeze-drying, or encapsulation technologies effectively prevent their loss during preparation.

TCM granules can be designed to exhibit different drug release characteristics according to therapeutic needs. Immediate-release granules disintegrate and release drugs rapidly, enabling quick therapeutic effects. For example, Su Xiao Jiu Xin Wan granules, used to treat acute angina pectoris, dissolve and absorb quickly when taken sublingually, alleviating symptoms within 1–2 minutes^[13].

Sustained-release granules, on the other hand, use specialized formulation techniques such as slow-release matrix materials or coating technologies to release drugs gradually and continuously within the body. This maintains stable blood drug concentrations, reduces dosing frequency, and improves patient adherence^[14].

4. Application prospects of traditional Chinese medicine granules

4.1. Application in clinical TCM treatment

In cardiovascular medicine, Astragalus granules improve cardiac function through multi-target mechanisms, enhancing myocardial contractility, dilating blood vessels, and reducing cardiac load, showing significant efficacy in chronic heart failure. In the study by Yang *et al.*^[15], patients with chronic heart failure who consumed Astragalus granules demonstrated better improvement in heart function classification compared to those using Western medicine. In respiratory medicine, Lianhua Qingwen granules have strong inhibitory effects on the influenza virus, effectively alleviating flu symptoms such as fever, cough, and fatigue, while maintaining good safety^[16]. In gastroenterology, the TCM granule Chaihu Shugan San provides mild and sustained therapeutic effects, gradually improving gastric symptoms in patients. For chronic gastritis, consuming Chaihu Shugan San can not only relieve discomforts such as stomach pain and bloating but also regulate emotions and prevent exacerbation caused by emotional distress. He^[17] suggested in his research that compared to the Western drug lansoprazole, Chaihu Shugan San has favorable clinical effects in treating chronic gastritis.

In surgery, the application of TCM granules is particularly noteworthy. For example, in fracture treatment, granules such as Jiegu Xujin granules promote blood circulation, reduce swelling and pain, accelerate fracture healing, and shorten recovery time ^[18]. In gynecology, Wuji Baifeng granules help regulate female endocrine functions, improving symptoms like menstrual irregularities, dysmenorrhea, and amenorrhea. Clinical practice has shown that Wuji Baifeng granules also assist in regulating menstrual cycles and ovulation functions in patients with polycystic ovary syndrome, improving pregnancy rates ^[19]. In pediatrics, considering the immature liver and kidney functions of children, TCM granules like Xiao'er Ganmao granules and Xiao'er Zhike granules offer high safety and confirmed efficacy. These granules, through proper formulation and dosage control, effectively alleviate symptoms, shorten recovery time, and provide safe and effective treatment for children.

4.2. Application in preventive healthcare

With the accelerating pace of modern life and heightened health awareness, people are increasingly focusing on wellness and prevention, seeking scientific methods to prevent diseases and enhance physical fitness. In this context, TCM granules have demonstrated their advantages. For instance, for common sub-health conditions such as fatigue, insomnia, and low immunity, TCM granules like Ginseng granules and Astragalus granules exhibit remarkable effects in boosting energy, nourishing blood, calming the mind, and enhancing immunity. These granules are convenient to carry and consume, have good taste, and exhibit minimal side effects, making them ideal for long-term use as part of modern health maintenance routines ^[20]. For the elderly, granules such as Liuwei Dihuang granules and Goji berry granules, which replenish kidney essence and delay aging, can improve physical fitness and enhance the quality of life ^[21]. For women, granules like Rose granules and Angelica granules, which promote beauty and regulate endocrine functions, can help maintain a youthful appearance and alleviate menopausal symptoms.

In today's society, with the increasing pace of life and worsening environmental pollution, the incidence of various diseases continues to rise, prompting greater attention to disease prevention. TCM granules, as a convenient, efficient, and widely accepted form of TCM, exhibit great potential in disease prevention. For instance, in preventing respiratory infections like influenza, granules such as Banlangen granules and Honeysuckle granules possess significant heat-clearing, detoxifying, and antiviral properties, making them suitable for daily preventive use during flu seasons. Long-term consumption can enhance immunity and reduce the risk of influenza virus infections ^[22].

5. Conclusion

As a significant outcome of TCM formulation reform, TCM granules have continuously integrated modern technology throughout their development, showcasing numerous advantages. Their convenience, quality stability, and pharmacodynamic benefits offer broad application prospects in both clinical TCM treatment and preventive healthcare. With further research and technological advancements, TCM granules are expected to play a greater role in more fields, advancing the modernization and internationalization of TCM. However, challenges remain, such as standardizing the quality of compound TCM granules and evaluating the safety of their combined use with Western medicines. These issues require further in-depth research and exploration by medical and pharmaceutical researchers to fully realize the potential of TCM granules and contribute more significantly to global health.

Disclosure statement

The author declares no conflict of interest.

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