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Integration of Traditional Wisdom and Modern Science: A Review of Baatar-7 in Mongolian Medicine

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Abstract This paper provides a comprehensive summary of the historical background, formulation principles, chemical constituents, pharmacological mechanisms, clinical applications, and quality evaluation of Baatar-7 (also referred to as Babu-7 or Qixiong Wan). The findings underscore its potential for broader clinical use and further development through modern pharmaceutical technologies.

Key words Baatar-7, Mongolian medicine, Chemical constituent, Pharmacological mechanism

1 Introduction

The remarkable clinical efficacy of Mongolian medicine is the fundamental cornerstone and vital lifeline that have enabled its transmission across generations and sustained its relevance over time. Throughout its development, Mongolian medicine has been guided by ancient philosophical thought and naive materialism, integrating the unique characteristics of Mongolian nomadic culture. Through continuous accumulation, inheritance, and innovation, a distinctive approach to disease treatment has gradually been established, grounded in four key perspectives: holism, dialectics, balance, and dynamics. These four dimensions are integrated throughout the entire process of disease treatment[1].

Mongolian medicine employs theories such as Yin-Yang and the Five Elements to explain the universe and its interrelationships, forming the foundational "Three Roots and Seven Elements" theory. This theory posits that the foundation of life consists of the Three Roots, Seven Elements, and Three Impurities. Their dynamic balance and the unity of opposites constitute the basis of life activities and health[2-3]. Mongolian medicine emphasizes that health encompasses not only physical integrity but also psychological well-being and social harmony, recognizing that an individual's health is closely interrelated with their social and natural environment[4].

Mongolian medicine holds that although multiple factors may contribute to the onset of disease, the fundamental cause is the imbalance of the "Three Roots". Diseases are classified into six basic syndromes (Hiy, Shirā, Badagan, Blood, Xirausu, and Parasites), each of which is intrinsically classified as either cold or heat in nature[5]. Diagnosis relies on the three diagnostic methods—inspection, inquiry, and palpation—through which practitioners assess symptoms and signs to ascertain the cause, nature, and progression of a disease[6]. To systematically analyze complex disease phenomena, Mongolian medicine has developed a structured framework known as the "Ten Key Points of Differential Diagnosis". This method evaluates diseases across ten critical dimensions, including causative factors, symptoms, affected regions, and individual constitution, enabling a comprehensive diagnostic process[7-8]. This holistic and dialectical approach is not only the cornerstone of the Mongolian medical theoretical system but also a fundamental principle upheld in clinical practice.

This review focuses on Baatar-7, a representative formula in Mongolian medicine, to examine its traditional applications and modern scientific evidence supporting its use.

2 Historical description

Mongolian medicine Baatar-7 (also known as Babu-7 and translated as Qixiong Wan), often referred to as the "green antibiotic" of Mongolian medicine, originates from traditional handwritten prescriptions. The medicine was incorporated into the 1998 edition of the *Pharmaceutical Standards of the Ministry of Health of the People's Republic of China - Mongolian Medicine Volume* and is one of the most commonly used Mongolian patent medicines in contemporary clinical Mongolian medical practice. This formula is documented in several classic Mongolian medical texts, including the *Mongolian Medical Golden Treasury* (*Erdenin Sang*), the *Complete Collection of Mongolian Prescriptions*, the *Medical Handbook* (*Emqilegen gar debter*), the *Compilation of Mongolian Prescriptions* (*Mongol Emnelgen Jvrin Emhidgel*), the *Gaoshige Meilin Prescription* (*Gaoshige Meilinin Jvr*), and *Tongwa Gajide* (Fig. 1). Baatar-7 is formulated into water pills composed of seven medicinal ingredients, including Aconite leaves, Chebulic Myrobalan (*Terminalia chebula*), Madder root, Black incense, Cinnabar, Patrinia herb, and Musk. This formulation is intended to eliminate "Niyan" pathogenic factors, clear epidemic heat, detoxify the body, relieve pain, disperse blood stasis, and stop dysentery. It is primarily utilized for the treatment of severe epidemic fever, intestinal colic, smallpox, dysentery (including both red and white types), diphtheria, jaundice (characterized by yellowing of the eyes), various forms of enteritis, hoarseness and loss of voice, encephalitis, and cholera with muscle cramps. Baatar-7 is classified as a "Niyan" eliminating agent, indicating that it is primarily used to treat conditions related to intestinal inflammation, abdominal pain, and heat-related sticky syndromes. It is widely used in internal medicine, gynecology, dermatology, oph-

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thalmology, otorhinolaryngology (ENT), and stomatology (oral medicine), where it has demonstrated distinctive and effective therapeutic results in the treatment of various complex and difficult diseases.

NOTE Gaoshige Meilinin Jvr (A): the Gaoshige Meilin Prescription was compiled in the 19th century by Gaoshige Meilin, a renowned Mongolian medical scholar from Alxa Banner. It is an important and influential work in Mongolian medicine. Obidasen Dalai (B): it was written by Zhanbula, a famous Mongolian pharmacist during the 18th and 19th centuries. It is a complete and systematic monograph on Mongolian pharmacy. Mongol Emnelgen Jvrin Emhidgel (C): this book includes 1 026 prescriptions for the treatment of 78 diseases, presenting both established remedies and secret formulas accumulated over many years of clinical practice by renowned veteran Mongolian doctors. Mongol Anagahv Vhaganin Nebterhei tvli (D): this comprehensive medical encyclopedia was edited by Bai Qingyun, a renowned modern Mongolian physician. It is a complete and systematic reference work on Mongolian medicine.

Fig. 1 Selected Mongolian medical classics

3 Prescription principles

Baatar-7, composed of seven medicinal ingredients—*Aconitum kusnezoffii* leaves, *Terminalia chebula*, *Potentilla discolor*, *Rubia cordifolia*, *Stellera chamaejasme*, cinnabar, and musk—exerts antipyretic, detoxifying, analgesic, thrombolytic, and antidiarrheal effects. It is indicated for the treatment of conditions such as epidemic febrile diseases, pneumonia, dysentery (both red and white), diphtheria, jaundice, aphonia, and cholera-induced muscle spasms. In accordance with the traditional Mongolian medical principle of "Sovereign, Minister, Assistant, and Envoy", *A. kusnezoffii* leaves serve as the sovereign herb, playing a central role in clearing heat and toxins, dispelling wind and cold, and alleviating pain and inflammation. This herb is particularly effective in treating fever, infections, and inflammatory conditions caused by epidemics, pneumonia, or dysentery. *T. chebula* and *P. discolor*, as minister herbs, exhibit astringent, antidiarrheal, and hydrating properties, making them effective in the treatment of dysentery and cholera, while also enhancing anti-inflammatory and antimicrobial activities. *R. cordifolia* and *S. chamaejasme*, classified as assistant herbs, promote blood circulation, relieve pain, and facilitate tissue recovery, with *S. chamaejasme* also acting as an aromatic dampness-resolving agent that alleviates pathological fluid viscosity, a concept in Mongolian medicine. Cinnabar and musk, functioning as envoy herbs, further calm the mind, detoxify the body, alleviate heat-induced neurological symptoms such as delirium and aphasia, activate blood circulation, unblock meridians, and revive consciousness, thereby enhancing overall efficacy and drug absorption. Overall, Baatar-7 primarily exerts effects of heat clearance, detoxification, elimination of pathological viscosity, hemostasis, and restoration of homeostasis, making it particularly effective in treating hyperthermic, infectious, and gastrointestinal disorders, thereby holding significant clinical value within the Mongolian medical system.

4 Chemical constituents

4.1 *A. kusnezoffii* leaves *A. kusnezoffii* leaves, the dried leaves of *A. kusnezoffii* Reichb. (Ranunculaceae), are commonly used in Mongolian medicine for their heat-clearing, detoxifying, and analgesic effects. Modern studies have shown that the chemical constituents of *A. kusnezoffii* leaves mainly include diterpene alkaloids, flavonoids, phenolic acids, polysaccharides, and volatile oils, with diterpene alkaloids being the primary active components and the main contributors to the plant's toxicity[9]. Diterpene alkaloids are categorized into C19- and C20-diterpene alkaloids according to their skeletal structures. The C19-diterpene alkaloids, which exhibit strong toxicity, primarily include aconitine, mesaconitine, and hypaconitine. Studies have demonstrated that these compounds possess significant analgesic and anti-inflammatory effects, but also exhibit cardiotoxicity and neurotoxicity, thereby necessitating strict dosage control[10]. In contrast, C20-diterpene alkaloids, such as talatisamine, songorine, and neoline, demonstrate lower toxicity. Several C20-diterpene alkaloids isolated from *A. kusnezoffii* leaves have been found to exhibit antitumor activity, though their underlying mechanisms remain to be elucidated. Additionally, *A. kusnezoffii* leaves are rich in flavonoids, such as quercetin, kaempferol, and their glycoside derivatives. Multiple flavonoid compounds were identified in *A. kusnezoffii* leaves using high-performance liquid chromatography-mass

spectrometry (HPLC-MS). These compounds possess antioxidant and anti-inflammatory activities, which may be related to their heat-clearing effects[11]. The phenolic acid components, such as chlorogenic acid and caffeic acid, are also found in *A. kusnezoffii* leaves. Wan *et al.*[12] found that these compounds exhibit strong free radical scavenging ability, which may contribute significantly to the antioxidant properties of *A. kusnezoffii* leaves .

Furthermore, *A. kusnezoffii* leaves contain polysaccharides that may have immunomodulatory effects; however, studies investigating these effects are currently limited. The volatile oil components mainly consist of monoterpenes and sesquiterpenes, which may be responsible for their distinctive aroma, although their specific pharmacological activities have not yet been fully elucidated.

4.2 *T. chebula* *T. chebula* Retz., a species within the Combretaceae family, is commonly used in traditional Mongolian and Tibetan medicine. It exhibits astringent properties and is utilized for its anti-diarrheal and antitussive effects. Modern research has revealed that *T. chebula* contains a variety of bioactive compounds, primarily tannins, triterpenoids, phenolic acids, and flavonoids, with hydrolyzable tannins identified as the most significant active constituents[13]. Tannins constitute approximately 30% –40% of *T. chebula* and are categorized into two main types: hydrolyzable tannins, such as chebulic acid, chebulagic acid, chebulinic acid, and ellagic acid; and condensed tannins, such as proanthocyanidins. Studies have demonstrated that these compounds exhibit antioxidant, anti-inflammatory, and antimicrobial activities, which may contribute to the herb's therapeutic effects on digestive disorders[14].

In addition to tannins, *T. chebula* contains a variety of triterpenoids, primarily oleanane- and ursane-type compounds, including chebulinol, arjunglucoside, oleanolic acid, and ursolic acid. These compounds have been reported to possess hepatoprotective and anti-tumor activities, potentially mediated through the regulation of the NF-κB signaling pathway[15]. Phenolic acids, such as gallic acid, protocatechuic acid, and caffeic acid, are also widely distributed in *T. chebula*, exhibiting significant antioxidant and antimicrobial activities[16]. Moreover, *T. chebula* contains flavonoids (*e. g.*, quercetin, kaempferol), anthraquinones (*e. g.*, emodin), and volatile oils (*e. g.*, α-pinene, limonene), all of which may contribute to its pharmacological effects. Processing methods influence the chemical composition and therapeutic efficacy of *T. chebula*. Studies have shown that processing reduces tannin content, leading to the conversion of certain tannins into ellagic acid. Furthermore, when combined with *Glycyrrhiza uralensis* (licorice) or *Coptis chinensis* (Huanglian), its anti-ulcer and antibacterial activities are enhanced.

In summary, *T. chebula* is rich in bioactive compounds, and its pharmacological effects are closely related to its chemical constituents. These findings provide a scientific basis for further pharmacological research and clinical applications.

4.3 *P. discolor* Bunge *P. discolor* Bunge, a species within the Rosaceae family and the genus *Potentilla*, is a traditional Mongolian medicinal herb known for its heat-clearing, detoxifying, cooling blood, and hemostatic effects. Modern research indicates that the main chemical constituents of *P. discolor* include flavonoids, triterpenoids, phenolic acids, tannins, and polysaccharides, with flavonoids and triterpenoids being the primary active components.

Flavonoids are the most important active compounds in *P. discolor*, possessing antioxidant, anti-inflammatory, and antibacterial properties. The identified flavonoids include quercetin, kaempferol, myricetin, and rutin, which have demonstrated strong free radical-scavenging abilities, potentially contributing to their antioxidant and anti-inflammatory effects[17-18]. Additionally, dihydroflavonoid compounds such as naringenin and hesperetin have also been isolated. The triterpenoid constituents of *P. discolor* mainly consist of oleanane-type and ursane-type triterpenes, which exhibit anti-inflammatory and hepatoprotective activities. The oleanane-type triterpenes include oleanolic acid and tormentic acid, while the ursane-type triterpenes include ursolic acid and corosolic acid. Studies have shown that these triterpenoids may confer hepatoprotective effects, potentially by inhibiting oxidative stress[19].

In addition, *P. discolor* contains phenolic acids such as gallic acid, protocatechuic acid, and caffeic acid, which have demonstrated antibacterial and antioxidant effects. These compounds may be linked to the traditional use of *P. discolor* in treating dysentery and enteritis[20]. Moreover, *P. discolor* is abundant in hydrolysable tannins, such as ellagic acid and gallotannins, which contribute to its astringent and hemostatic properties. These tannins may be effective in treating gastrointestinal bleeding and external injuries.

Furthermore, polysaccharides derived from *P. discolor* exhibit immunomodulatory effects, though current research on their structure and bioactivity is limited, necessitating further investigation.

4.4 *R. cordifolia* L. *R. cordifolia* L., a species within the Rubiaceae family and the genus *Rubia*, is a traditional Mongolian medicinal herb known for its blood-cooling, hemostatic, blood-activating, and stasis-removing properties. Modern research has shown that its chemical constituents primarily include anthraquinones, naphthoquinones, cyclic peptides, polysaccharides, and organic acids, with anthraquinones identified as the most significant active components. Anthraquinones are the most characteristic chemical constituents of *R. cordifolia* and serve as its primary pharmacological foundation. These compounds include both free anthraquinones and glycosylated anthraquinones, such as alizarin, emodin, purpurin, 1, 3-dihydroxyanthraquinone, rubian, and physcion-8-O-β-D-glucoside. Studies have demonstrated that these anthraquinones exhibit notable antibacterial, anti-inflammatory, and antitumor activities. Specifically, purpurin and emodin have shown inhibitory effects on various tumor cell lines[21-22].

Additionally, *R. cordifolia* contains several naphthoquinone derivatives, including shikonin, acetylshikonin, and β-hydroxyisovalerylshikonin, which possess antibacterial and antitumor properties. Research has indicated that shikonin and its deriva-

tives can inhibit multiple drug-resistant bacterial strains, thereby representing promising candidates for the development of novel antibiotics[23]. Furthermore, *R. cordifolia* is rich in bioactive cyclic peptides, such as the RA-series cyclopeptides (RA-I to RA-VII) and rubiyunnanins A-C. These cyclic peptides exhibit significant immunomodulatory and antitumor activities, with RA-VII showing strong cytotoxic effects against leukemia HL-60 cell lines[24].

In addition, *R. cordifolia* contains polysaccharides that enhance macrophage phagocytosis, thereby contributing to its immunoregulatory properties. Its organic acid constituents include caffeic acid, chlorogenic acid, and succinic acid. Moreover, the plant is rich in trace elements such as iron (Fe), zinc (Zn), and copper (Cu), which may be associated with its hematopoietic properties.

4.5 *S. tonkinensis* *S. tonkinensis* (Pierre) Craib ex Hartwich, a species within the Styracaceae family, is a traditional Mongolian medicinal herb known for its properties in stimulating consciousness, promoting circulation, and invigorating blood flow. Modern research has identified its primary chemical constituents, including phenylpropanoids, terpenoids, aromatic acids, and essential oils, with phenylpropanoids being the most significant active compounds[25]. The phenylpropanoid compounds in *S. tonkinensis* include coumarins and lignans, such as esculetin, umbelliferone, scopoletin, pinoresinol, and lariciresinol. Studies indicate that these compounds exhibit potent anti-inflammatory, antioxidant, and neuroprotective activities, with esculetin demonstrating significant protective effects on the central nervous system[26].

Additionally, *S. tonkinensis* contains a variety of terpenoids, including monoterpenes like α-pinene and β-pinene, as well as sesquiterpenes such as β-caryophyllene and α-humulene. Research suggests that these terpenoids can inhibit multiple inflammatory factors, which may contribute to the plant's anti-inflammatory properties[27]. The plant is also rich in aromatic acid compounds, including cinnamic acid, p-coumaric acid, and ferulic acid. These compounds exhibit antioxidant and antibacterial activities, which may be linked to the traditional medicinal applications of *S. tonkinensis*[28]. Moreover, the essential oil of *S. tonkinensis* contains major components such as benzyl benzoate, phenylethyl alcohol, and cinnamyl acetate, all of which have been shown to possess sedative and antibacterial effects.

Furthermore, *S. tonkinensis* contains flavonoids such as quercetin and kaempferol, as well as sterols like β-sitosterol and stigmasterol. These compounds collectively contribute to the plant's diverse pharmacological activities and its potential for broad clinical applications.

4.6 Cinnabar Cinnabar, primarily composed of mercury sulfide (HgS), is a traditional mineral-based Mongolian medicine known for its sedative, calming, and detoxifying effects. Modern research indicates that its chemical composition is predominantly inorganic, containing only trace amounts of organic compounds and trace elements. The main active components are α-HgS (cinnabar-type, hexagonal crystal system) and β-HgS (metacinnabar-type, cubic crystal system). Medicinal cinnabar typically contains more than 95% α-HgS, which serves as its primary active ingredient. Varitions in preparation methods alter the ratio of crystal phases, thereby affecting its pharmacological effects[29-30].

Additionally, cinnabar contains trace mineral elements such as selenium (Se), tellurium (Te), and zinc (Zn), as well as small amounts of adsorbed organic matter and amino acids. A study conducted by Hgsp[31] detected trace amounts of sulfur-containing amino acids like cysteine in natural cinnabar, which may be related to mercury transport and metabolism. Furthermore, the processing method of cinnabar significantly impacts its composition and therapeutic efficacy. The water-grinding method effectively removes soluble mercury salts and decreases the free mercury content. In terms of compatibility, combining cinnabar with *Glycyrrhiza* (licorice) reduces its toxicity, whereas pairing it with *C. chinensis* (Huanglian) enhances its antibacterial activities[32]. Studies have shown that traditional processing methods significantly reduce the bioavailable mercury content in cinnabar, thereby optimizing its therapeutic effects and safety.

4.7 Musk Musk is the dried secretion obtained from the mature male musk glands of *Moschus berezovskii*, *M. sifanicus*, or *M. moschiferus*. It is a precious traditional Mongolian medicine known for its ability to stimulate consciousness, promote blood circulation, relieve swelling, and alleviate pain. Modern research has shown that the chemical composition of musk primarily includes macrocyclic ketones, steroids, proteins, and peptides. Notably, muscone (3-methylcyclopentadecanone) is identified as the principal active component, constituting approximately 0.5% -2.0% of musk. Muscone is not only responsible for its distinct fragrance but also serves as a key pharmacological component. Studies have demonstrated that muscone exhibits significant anti-inflammatory, neuroprotective, and cardiovascular protective effects[33]. Its unique 15-membered ring structure confers exceptional lipophilicity and facilitates transdermal absorption[34]. Additionally, musk contains other macrocyclic ketones, such as cyclopentadecanone and cyclotetradecanone.

Musk is characterized by a high steroid content, including cholesterol, cholest-4-en-3-one, and testosterone, which are thought to contribute to its hormone-like effects and its capacity to promote tissue regeneration[35]. Furthermore, musk contains proteins and bioactive peptides, including moschoprotein and antimicrobial peptides, with some peptides showing antibacterial and anti-inflammatory activity, which may underlie its traditional use in external medicinal applications[36]. Apart from these major compounds, musk also contains various amino acids (glutamic acid, aspartic acid, arginine), inorganic elements (potassium, sodium, calcium, magnesium), and fatty acids (palmitic acid, oleic acid). Collectively, these constituents contribute to the complex chemical composition of musk and may play a synergistic role in its pharmacological effects (Fig. 2).

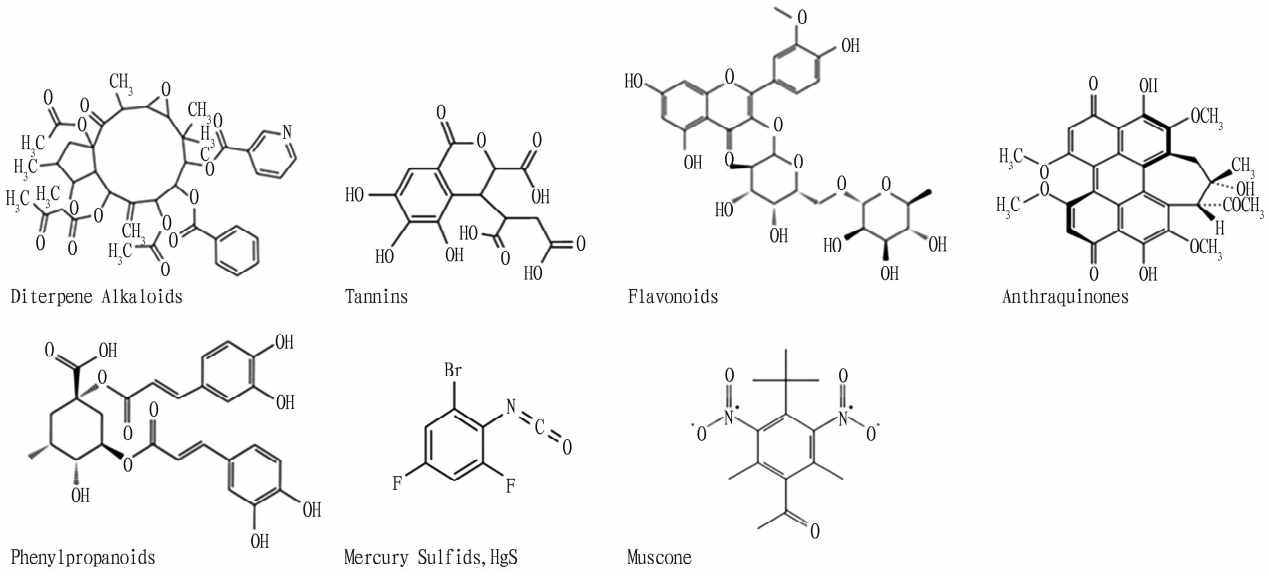

Fig. 2 Chemical structures of main chemical constituents of Baatar-7

5 Pharmacological effects of Baatar-7

5.1 Antitumor effects Wen Jianxun *et al.* [37] discovered that the Mongolian medicine Baatar-7 exerts a significant inhibitory effect on oral cancer KB cells. Morphological observations revealed that after treatment with Baatar-7, KB cells underwent shrinkage, adopted a more rounded shape, showed cytoplasmic irregularities with decreased transparency, and exhibited a marked increase in extracellular secretions. Cell growth was inhibited, proliferation during the logarithmic phase slowed down, and morphological features characteristic of apoptosis were observed. These findings suggest that Baatar-7 may exert its antitumor effects on KB cells by inducing apoptosis.

Additionally, Deng Xiuling *et al.* [38] reported that Baatar-7 significantly inhibited the proliferation of gastric and colon cancer cells, demonstrating a concentration-dependent cytotoxic effect, where the inhibitory rate increased with increasing drug concentration. Similarly, Ulji Tegus *et al.* [39] conducted *in vitro* experiments on gastric cancer cells and observed that Baatar-7 significantly inhibited their growth, also displaying a dose-dependent cytotoxic effect.

5.2 Anti-inflammatory effects Baatar-7 exhibits significant anti-inflammatory effects, effectively alleviating inflammation symptoms and reducing the release of inflammatory mediators. Studies have shown that Baatar-7 has remarkable anti-inflammatory effects on subacute thyroiditis, mastitis, and trachoma. The active ingredients in Baatar-7, such as *Aconitum* leaves, *T. chebula*, and *Paridis japonica*, have been shown to inhibit the activities of cyclooxygenase (COX) and lipoxygenase (LOX), thereby reducing the synthesis of inflammatory mediators, such as prostaglandin E2 (PGE2) and leukotrienes (LTs) [40].

A clinical study conducted by Wurentuya *et al.* [41] involved 80 patients diagnosed with subacute thyroiditis. Compared to conventional Western medicine treatment alone, the treatment group, which received Baatar-7 II in combination with conventional Western medicine, showed a significantly higher overall effective rate. These findings provide clinical evidence supporting the effectiveness of Baatar-7 in treating subacute thyroiditis.

5.3 Antibacterial activity Baatar-7 exhibits significant antibacterial effects against a range of bacterial species. *In vitro* experiments have demonstrated that Baatar-7 effectively inhibits *Staphylococcus aureus*, *S. albus*, *Pseudomonas aeruginosa*, and other bacterial strains, with its antibacterial activity positively correlated with drug concentration. Baatar-7 particularly inhibits common pathogenic bacteria, such as *S. aureus*, *S. albus*, and *P. aeruginosa*. The components of Baatar-7, including Heiyunxiang and Shexiang, have the capacity to disrupt bacterial cell membranes, thereby inhibiting bacterial growth and reproduction [42].

Additionally, *in vitro* experiments have confirmed that Mongolian medicine Baatar-7 exhibits antibacterial activity against *S. aureus*, *S. albus*, *P. aeruginosa*, *Bacillus anthracis*, *Proteus* spp., *Streptococcus pyogenes* (Group A *Streptococcus*), and *S. agalactiae* (Group B *Streptococcus*).

5.4 Antioxidant activity Baatar-7 exhibits significant antioxidant activities, effectively scavenging free radicals and protecting cells from oxidative damage. The components of Baatar-7, such as *T. chebula* and *P. discolor*, have been shown to enhance the activities of superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px), thereby reducing the production of lipid peroxides. Baatar-7 is used for the prevention and treatment of oxidative stress-related diseases, such as cardiovascular diseases and neurodegenerative disorders (Fig. 3).

6 Clinical efficacy

6.1 Treatment of digestive system diseases Ana *et al.* [43] conducted a study involving 85 patients with chronic gastritis, comparing the efficacy of the standard triple therapy alone versus

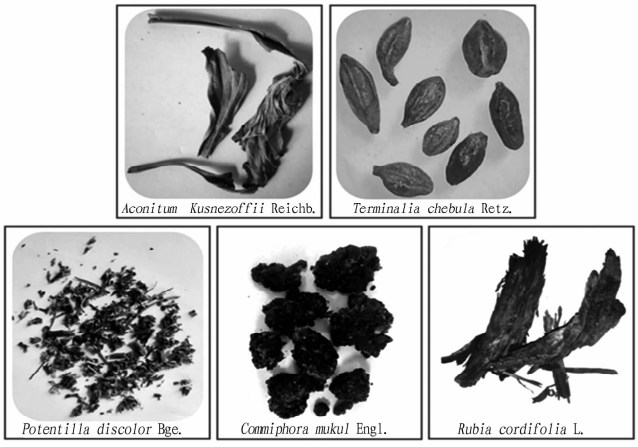

Fig. 3 Constituents of Baatar-7 derived from plants

the standard triple therapy combined with Baatar-7. The results showed that the combination therapy had fewer toxic side effects, a higher overall efficacy rate, a greater reduction in *Helicobacter pylori* (Hp) infection, and a shorter treatment duration. Additionally, it significantly inhibited the growth of pathogenic gastrointestinal flora and improved the intestinal environment, demonstrating broad clinical applicability and providing a promising treatment option for patients with gastritis.

Siqintu *et al.* [44] conducted a study involving 26 patients with peptic ulcers who received conventional triple therapy in combination with Baatar-7. The results indicated a significant therapeutic effect, including notable symptom relief, improved ulcer healing, and a reduced risk of ulcer recurrence, highlighting its potential for widespread clinical application.

Zhang Ruifen *et al.* [45] conducted a study involving 382 patients with acute diarrhea, comparing the effects of Baatar-7 with berberine tablets. The results showed that oral administration of Baatar-7 was significantly more effective. Treatment with Baatar-7 led to fewer adverse reactions, more effective symptom relief, a reduced frequency of abdominal pain episodes, and shorter duration of these episodes. These findings strongly support the use of Baatar-7 (Baatar-7 flavored pills) as an effective treatment for acute diarrhea.

6.2 Tumor treatment Significant progress has been made in investigating the anti-tumor effects of Baatar-7. *In vitro* experiments have shown that Baatar-7 has a significant inhibitory effect on various cancer cell lines, including gastric cancer MGC-803 cells, colon cancer LOVO cells, and oral epidermoid carcinoma KB cells. This inhibitory effect is dose-dependent. Baatar-7 inhibits the proliferation and growth of tumor cells by inducing apoptosis and causing cell cycle arrest in cancer cells.

6.3 Treatment of skin diseases Zhao Fengyan *et al.* [46] conducted a study involving 285 patients with psoriasis who were treated using a combination of oral and topical Mongolian medicines, including Baatar-7, Eerdeni uril, Wulichu-18, Basiburu-5, and Smilax glabra-7. The treatment was based on the principle of balancing the three humors, reducing excessive yellow water, and improving Hi and blood circulation. This approach effectively alleviated recurrent symptoms and demonstrated reliable clinical efficacy, warranting further promotion.

Qin Haihong *et al.* [47] conducted a study involving 148 patients with plaque psoriasis. The control group was treated with acitretin capsules and topical mometasone furoate cream, while the observation group received the same treatment supplemented with Baatar-7. After treatment, the PASI index in the observation group was significantly elevated, suggesting an improved cure rate and demonstrating the unique efficacy of Baatar-7 in the diagnosis and treatment of psoriasis. Fei Jiansou *et al.* [48] conducted a study involving 134 patients with pustular acne. The control group was administrated oral erythromycin capsules and topical mupirocin ointment, whereas the treatment group received an adjusted oral prescription of Baatar-7 in combination with topical application of Wuwei Xiaodu decoction. The therapeutic effect in the treatment group was significantly superior, with no toxic side effects detected and notable improvement in symptoms. These findings confirm the definite efficacy of Baatar-7 in the treatment of pustular acne.

Yang Xiaoling *et al.* [49] conducted a study involving 52 patients with herpes zoster, who were divided into two groups. Both groups received standard Western medicine treatment, while the observation group was additionally administered Baatar-7, Huhegaridi-9, and Garidi-5. The results showed that the observation group had a higher therapeutic effect, experienced a shorter duration of symptom resolution, and provided strong clinical evidence supporting the unique efficacy of Baatar-7 in treating herpes zoster. Qimuge *et al.* [50] conducted a study involving 68 patients with chronic urticaria. The control group was treated with ebastine and vitamin C, while the observation group received Baatar-7, Garidi-5, and Chagan decoction. The results indicated that the observation group had a higher cure rate and no observed toxic side effects, demonstrating the significant clinical value of Baatar-7 in the treatment of chronic urticaria. Zheng Fenghe[51] conducted a study involving 112 patients with erysipelas. Both the control and observation groups were treated with penicillin, but the observation group was additionally administered Baatar-7. Comparative analysis revealed that the observation group had superior efficacy, reduced systemic and local symptoms, and a lower recurrence rate. These findings suggest that Baatar-7 does not induce antibiotic resistance and demonstrates a confirmed clinical effect in treating erysipelas.

6.4 Treatment of otorhinolaryngological diseases Zhou Jianping *et al.* [52] conducted a study involving 120 patients with acute tonsillitis, who were randomly assigned to three groups of 40 participants each. The treatment group received Baatar-7 in combination with oral cefradine capsules. The results showed that Baatar-7 significantly shortened the healing time, as well as the duration of sore throat and fever, without any observed toxic side effects, thereby confirming its efficacy.

Zhu Lixin *et al.* [53] conducted a study involving 120 patients with vocal cord nodules. The control group was treated with Jin Sang San Jie Wan alone, whereas the treatment group received a combination of Baatar-7 and Jin Sang San Jie Wan. The treatment

group demonstrated superior outcomes, including a shorter treatment duration and a lower recurrence rate. These findings confirm that the combination of Jin Sang San Jie Wan and Baatar-7 significantly enhances the therapeutic efficacy for vocal cord nodules and warrants further promotion.

7 Quality evaluation

7.1 Microscopic identification Microscopic examination of the powdered sample, mounted in chloral hydrate, revealed several characteristic structures when observed under a light microscope. Non-glandular hairs were observed in two forms: single-celled, sickle-shaped hairs densely covered with verrucose protuberances, thin-walled, measuring 13 – 35 μm in diameter and 125 – 225 μm in length; and single-celled, slightly curved or twisted hairs with smooth surfaces, measuring 10 – 22 μm in diameter and approximately 1 000 μm in length. Calcium oxalate cluster crystals (7 – 9 μm in diameter) were observed in the parenchymal tissues. Stomata were classified as either anomocytic or anisocytic types, each accompanied by 3 – 4 subsidiary cells. Needle-like calcium oxalate crystals were observed either scattered individually or aggregated in clusters. Fibers were colorless or pink with thick walls, while pericarp fibers were bundled, pale yellow, occasionally arranged in an oblique interlacing pattern, and exhibited thin walls with pitted markings. Stone cells displayed thick walls with bordered pits and small lumens. Starch granules were observed in either single or compound forms, with human- or semicircular-shaped hila, and diameters ranging from 20 to 40 μm (observed without heating). Irregular granules were dark reddish-brown with blackish margins and were often associated with reddish-brown amorphous masses. Resin masses appeared light red with spotted inclusions, and columnar crystals were also detected. Additionally, semi-transparent pale yellow masses composed of irregular granules were noted, in which crystals of square, columnar, octahedral, or irregular shapes were either embedded or dispersed.

7.2 Physicochemical identification A total of 1 g of the powdered sample was extracted with 20 mL of 0.5% hydrochloric acid-ethylene glycol solution under reflux for 2 h and filtered while hot. Then, 1 mL of the filtrate was tested with the following reagents: the addition of 1 – 2 drops of iodine-potassium bismuth iodide reagent produced a red coloration; the addition of 1 – 3 drops of potassium mercuric iodide reagent resulted in a white precipitate; and the addition of 2 – 3 drops of silicotungstic acid solution yielded a grayish-white precipitate. In a repeated test, 1 g of the sample was extracted and filtered under the same conditions. Subsequently, 1 mL of the filtrate was mixed with 1 – 2 drops of potassium mercuric iodide solution, producing a white precipitate, and with 2 – 3 drops of silicotungstic acid solution, forming a grayish-white precipitate. Additionally, 1 g of the sample was soaked in 10 mL of warm water for 20 min and filtered. Upon adding 1 drop of ferric chloride reagent to 1 mL of the filtrate, a dark blue coloration was observed.

7.3 Qualitative identification by thin-layer chromatography (TLC) Thirty pills of the sample (9 g) were extracted with 36 mL of diethyl ether under reflux for 2 h and subsequently filtered to obtain the test solution. A simulated prescription was prepared according to the original formula, extracted and filtered in the same manner to serve as the simulated prescription control solution. Individual crude drugs from the prescription were extracted in a similar manner to obtain reference solutions, with the musk reference solution prepared using muscone as the standard reference compound. A blank control solution was prepared by excluding musk from the prescription, followed by the same extraction and filtration process.

8 Conclusions and prospects

Baatar-7 represents a classical formulation in traditional Mongolian medicine, exhibiting documented antitumor, anti-inflammatory, antimicrobial, and antioxidant activities. Current research supports its clinical applications in the treatment of gastrointestinal disorders, cancers, dermatological conditions, and otorhinolaryngological diseases. Future research should focus on: elucidating the precise molecular mechanisms underlying the pharmacological effects of Baatar-7; developing novel formulations using modern pharmaceutical technologies; conducting large-scale, multicenter clinical trials to confirm its efficacy and safety; exploring potential applications in cardiovascular and neurodegenerative disorders; and promoting international collaboration and market introduction. Through continued research and development, Baatar-7 holds significant potential to contribute to global healthcare by bridging traditional wisdom and modern science.

Baatar-7 (Babu-7), a classical formulation in traditional Mongolian medicine, has a long-standing history and extensive clinical application. Modern pharmacological studies have demonstrated that Baatar-7 possesses a wide range of bioactivities, including antitumor, anti-inflammatory, antimicrobial, antioxidant, and analgesic effects. The formulation contains a diverse array of chemical constituents such as alkaloids, flavonoids, phenolic acids, and polysaccharides, which synergistically contribute to its therapeutic efficacy. Clinically, Baatar-7 has been widely used to treat gastrointestinal disorders, cancers, dermatological conditions, and diseases of the ear, nose, and throat, yielding significant outcomes. Particularly in oncology, Baatar-7 exhibits promising potential by inducing apoptosis and causing cell cycle arrest in cancer cells, thereby inhibiting tumor cell proliferation and growth. Additionally, its anti-inflammatory, antimicrobial, and antioxidant properties provide a solid scientific foundation for its use in the treatment of various diseases. Collectively, these findings support the continued study and clinical development of Baatar-7 as a valuable traditional medicine with modern therapeutic relevance.

Baatar-7 holds great promise for future research and clinical applications. Although existing studies have demonstrated its significant antitumor, anti-inflammatory, and antimicrobial activi-

ties, the precise molecular mechanisms underlying these effects have yet to be fully elucidated. In particular, the mechanisms by which Baatar-7 induces apoptosis in cancer cells and inhibits the release of inflammatory mediators warrant further investigation. With the advancement of modern pharmaceutical technologies, Baatar-7 may be developed into novel drug formulations, such as nano-formulations and sustained-release preparations, to enhance its bioavailability and therapeutic efficacy. Moreover, modern extraction and purification techniques can be employed to optimize the isolation of its active constituents, thereby improving both the purity and potency of the final product.

Clinically, Baatar-7 has shown remarkable efficacy in the treatment of gastrointestinal disorders, tumors, and dermatological diseases. Its therapeutic potential could be further expanded to include other conditions, such as cardiovascular diseases and neurodegenerative disorders. To further confirm the clinical efficacy and safety of Baatar-7, large-scale, multicenter clinical trials should be conducted to provide more robust evidence. Additionally, combining Baatar-7 with other therapeutic agents could be explored to assess potential synergistic effects. As a representative formula of Mongolian medicine—an integral part of traditional Chinese medicine—Baatar-7 also holds significant potential in the international pharmaceutical market. Through international collaboration and promotion, it can be introduced to the global market, offering new treatment options to patients worldwide. In conclusion, Baatar-7 represents a promising convergence of traditional wisdom and modern science. With continued interdisciplinary research and development, it is well-positioned to make significant contributions to human health and serve as a model for the modernization of traditional medicines.

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