

Analysis of medication patterns in the differentiation and treatment of acute gout using traditional Chinese medicine based on the auxiliary platform for traditional Chinese medicine inheritance

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Abstract: Based on the Traditional Chinese Medicine Inheritance Assistance Platform V3.0 software, this study retrieved literature on the differentiation and treatment of acute gouty arthritis using traditional Chinese medicine in China from 2013 to 2023. Through the establishment of a database, conducting relevant statistics on the data, and analyzing and summarizing the medication patterns and prescription drug characteristics of traditional Chinese medicine decoctions, the study provides a reference basis for clinical treatment of gout. The results indicate that 226 articles were selected, containing a total of 138 prescriptions. These prescriptions feature 254 types of drugs, primarily focused on coldness, including heat-clearing drugs, diuretic and dampness-reducing drugs, and blood-activating and stasis-resolving drugs. Among these, 20 types of drugs were used with a frequency of ≥ 20 , and three core combinations of commonly used drugs were identified. The conclusion drawn from this study is that the treatment of gout primarily focuses on clearing heat and dampness, removing blood stasis, unblocking collaterals, and relieving pain, with supplementary methods aimed at invigorating the spleen and kidney.

1. Introduction

Acute gouty arthritis (AGA) is a group of diseases directly related to purine metabolism disorders and decreased uric acid excretion leading to elevated blood uric acid levels. The main manifestations are redness, swelling, heat, pain, and limited function in the joints and surrounding tissues, with unbearable pain. The pain is characterized by a knife like and bite like texture, which worsens at night^{[1][2]} Non steroidal anti-inflammatory drugs are commonly used in western medicine for detumescence and pain relief, and have achieved certain clinical efficacy. However, long-term use of them has adverse reactions^{[3][4][5]}, such as gastrointestinal symptoms, liver and kidney function damage, skin rashes, and even increases the risk of tumor occurrence. Studies have found that the risk of atherosclerotic cardiovascular disease, stroke, heart failure, atrial fibrillation, and myocardial infarction in GA patients is about twice that in normal people^[6]. Gout belongs to the

categories of "Bi disease" and "Bai Hu Li Jie" in traditional Chinese medicine. As a disease name, it first appeared in Zhu Danxi's "Ge Zhi Yu Lun - Gout". Professor Lu Zhizheng believes that AGA is mainly characterized by pathogenic excess. When treating its symptoms, methods such as clearing heat and dampness, promoting blood circulation and removing stasis, and resolving phlegm and unblocking collaterals can be used^[7]. Professor Zhu Liangchun proposed the concept of "turbid blood stasis obstruction", which is mainly treated by purging turbidity and removing blood stasis, supplemented by lowering uric acid to promote metabolism. He also established the representative formula of "turbid blood stasis elimination method", Goufeng Tang^[8]. Professor Deng Yunming believes that gout is mainly caused by disharmony between the spleen and stomach, and dampness heat obstruction. He habitually uses the method of strengthening the spleen and stomach, clearing heat and promoting dampness to treat this disease^[9]. Professor Wu Shengyuan proposed the differential treatment of cold and heat, as well as the differentiation and treatment of internal and external factors. He used the "Gout Xiaozu mixture" and took traditional Chinese medicine orally to separate the cold and heat, while washing externally to clear heat, promote dampness, promote blood circulation, unblock collaterals, and relieve pain^[10]. Traditional Chinese medicine treatment for AGA has significant advantages in controlling gout symptoms, reducing adverse reactions, and improving patient quality of life. Therefore, it is necessary to explore the rules of traditional Chinese medicine medication for AGA. This study starts from the literature on the treatment of AGA with traditional Chinese medicine compound formulas, and explores the characteristics of AGA prescription medication through statistical analysis of four qi and five flavors, efficacy, drug frequency, association rules, cluster analysis, and other data mining methods, providing reference basis for clinical treatment.

2. Materials and Methods

2.1. Literature sourced from search strategies

The literature sources used advanced search functions to jointly search for keywords such as "acute gouty arthritis", "acute gouty arthritis", "acute gout", and "traditional Chinese medicine decoction", "traditional Chinese medicine", and "traditional Chinese medicine". Literature on the differentiation and treatment of acute gouty arthritis using traditional Chinese medicine from December 31, 2013 to January 1, 2023 was searched from (CNKI), Wanfang Data (Wanfang), and VIP Data (VPCS), and selected and entered into the database according to inclusion and exclusion criteria.

2.2. Inclusion criteria for literature

Include literature on the treatment of AGA with traditional Chinese medicine published in domestic journals from December 31, 2013 to January 1, 2023; The prescription for traditional Chinese medicine is for oral use, and the composition and dosage of the medication are clear. Literature with the same author, formula, and treatment method retrieved from different databases is counted as one article; The formula composition mentioned in the literature should include the drug and dosage, and the drug composition does not involve other ethnic minority drugs.

2.3. Exclusion criteria for literature

Animal or cell experimental research, theoretical exploration of traditional Chinese medicine, and review literature are not included; Literature without specific drug composition and clear dosage or incomplete prescription composition will not be counted; Dietary therapy literature is not included; Take only one duplicate publication of literature; The literature on the treatment of gouty joints with Chinese medicine in combination with other western medicine, surgery, physiotherapy,

topical medicine or acupuncture and moxibustion is not included; The literature on using traditional Chinese medicine intervention for treatment after adverse reactions to conventional Western medicine treatment is not counted; The literature on the efficacy of non oral drugs (including acupuncture and moxibustion, sticking and acupoint injection) is not included; The literature on the efficacy of ethnic minority drugs or the inclusion of ethnic minority drugs in the main formula is not included.

2.4. Data entry

After verifying the number of research cases, names of traditional Chinese medicine prescriptions, and drug compositions included in the literature using Excel 2020 software, the data was standardized. Refer to the Pharmacopoeia of the People's Republic of China^[11] and the Chinese Pharmacology^[12] to standardize the names of traditional Chinese medicine. The same traditional Chinese medicine with different medicinal parts and processing methods, but with the same efficacy, is counted as one medicine. The record of drug name, properties, taste, meridians, efficacy, and other information shall be based on the Chinese Pharmacology."And then, the user should input the processed data into the Traditional Chinese Medicine Inheritance Assistance Platform 3.0."

2.5. Data analysis

By utilizing the "Traditional Chinese Medicine Inheritance Calculation Platform V3.0" software to conduct statistical and mining analysis on medical case data, the "Statistical Analysis" and "Prescription Analysis" functions in the "Data Analysis" module of the software are mainly used to analyze the patterns of medication and formula composition.^{[13][14][15]}

3. Result

3.1. Data mining results

3.1.1. Frequency analysis

Table 1: Drug usage frequency ≥ 10 in prescriptions

Number	medicine	frequency	Number	medicine	frequency
one	Coix seed	eighty-one	eleven	Poria cocos	thirty-three
two	Huangbai	seventy-six	twelve	Red peony	thirty
three	Poria cocos	seventy-two	thirteen	Shanci Mushroom	twenty-six
four	Ox knee	sixty-nine	fourteen	Chuanxiong	twenty-one
five	Atractylodes macrocephala	sixty-eight	fifteen	Danshen	twenty-one
six	Bi Xie	sixty-three	sixteen	Peach kernel	twenty-one
seven	Alisma orientalis	forty-three	seventeen	Plantago seed	twenty
eight	Weiling Xian	forty-two	eighteen	Tiger staff	twenty
nine	angelica	thirty-six	nineteen	Self-defense	twenty
ten	Atractylodes macrocephala	thirty-four	twenty	Plantago asiatica	twenty

After screening, a total of 183 prescriptions were included, involving a total of 254 drugs. There were a total of 20 drugs with a frequency of use above 20, and the frequency of use was ranked from high to low. The results are shown in Table 1. The top 10 drugs with the highest frequency are Coix seed, Phellodendron bark, Poria cocos, Achyranthes bidentata, Atractylodes macrocephala, Bixie, Zexie, Weilingxian, Angelica sinensis, and Atractylodes macrocephala.

3.1.2. Statistical analysis of gender, taste, and meridian distribution

After analyzing and summarizing the included prescriptions, it was found that the drug properties were mainly cold (595, 38.54%), followed by warm (443, 28.69%) and flat (373,

24.16%). The results are shown in Table 2 and Figure 1; In terms of medicinal taste, the frequency of using sweet drugs is the highest (843,36.73%), followed by bitterness (775,33.77%) and bitterness (472,20.57%). The results are shown in Table 2 and Figure 2; The main meridians of drugs are liver meridian, spleen meridian, stomach meridian, lung meridian, and kidney meridian, with frequencies of 753603565510483, respectively. The results are shown in Figure 3.

Table 2: Four Qi and Five Flavors of Drugs

Four Qi	Frequency (times)	Frequency (%)	Five flavors	Frequency (times)	Frequency (%)
cold	five hundred and ninety-five	38.54%	Gan	eight hundred and forty-three	36.73%
temperature	four hundred and forty-three	28.69%	bitter	seven hundred and seventy-five	33.77%
flat	three hundred and seventy-three	24.16%	Xin	four hundred and seventy-two	20.57%
cool	one hundred and nineteen	7.70%	acid	one hundred and eight	4.70%
heat	fourteen	0.91%	salty	ninety-seven	4.23%

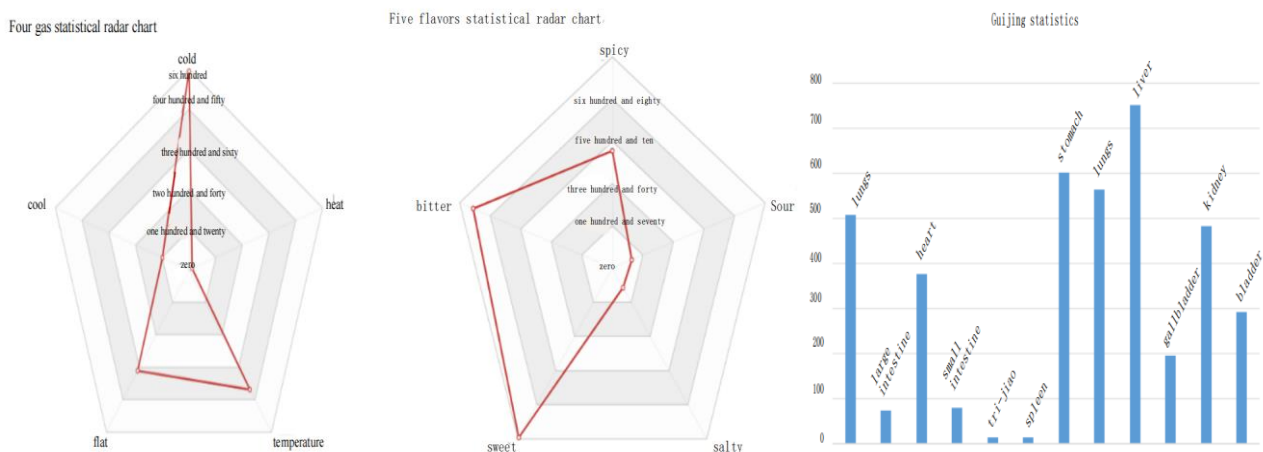


Figure 1: Four gas statistical radar Figure 2: Five flavor statistical radar Figure 3: Meridian statistics

3.1.3. Drug efficacy

"Researchers classify and analyze the efficacy of the top 40 traditional Chinese medicines, identifying 8 categories of efficacy." Among them, the top 3 most commonly used categories are heat clearing drugs (399 times, 26.71%), diuretic and dampness penetrating drugs (286 times, 19.14%), and blood activating and stasis resolving drugs (228 times, 15.26%). See Table 3.

Table 3: Efficacy and Frequency of Drug Groups

efficacy	Frequency (times)	Frequency (%)	efficacy	Frequenc(times)	Frequency (%)
Heat clearing class	three hundred and ninety-nine	26.71%	Humidifying class	seventy-five	5.02%
Diuretic and dampness permeable type	two hundred and eighty-six	19.14%	Table solving class	sixty-seven	4.49%
Promoting blood circulation and removing blood stasis	two hundred and twenty-eight	15.26%	Calming liver and calming wind	twenty-eight	1.87%
Tonifying deficiency class	two hundred and ten	14.06%	Physiological and Qi related	twenty-two	1.47%
Dispelling wind and dampness	one hundred and sixty-three	10.91%	Laxative class	sixteen	1.07%

3.1.4. Analysis of prescription patterns based on correlation

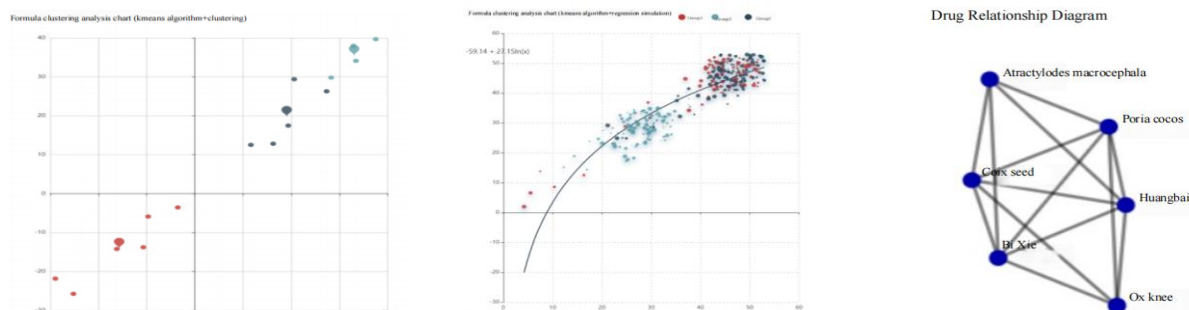
Table 4: Drug combination and frequency (with a support score of 33 and a confidence level of ≥ 0.60)

Number	Drug combination	Frequency (times)	Number	Drug combination	Frequency (times)
one	Coix seed, yellow cypress	fifty-four	thirteen	Coix seed, yellow cypress, ox knee	forty
two	Huangbai, Cangzhu	fifty-four	fourteen	Poria cocos, Ox knee	forty
three	Coix seed, Atractylodes macrocephala	fifty-one	fifteen	Cangzhu, Bixie	thirty-eight
four	Coix seed, Poria cocos	fifty	sixteen	Ox knee, Bi Xie	thirty-six
five	Coix seed, Ox knee	fifty	seventeen	Coix seed, yellow cypress, soil Poria cocos	thirty-six
six	Huangbai, Tufu Ling	forty-eight	eighteen	Huangbai, Tufu Ling, Cangzhu	thirty-five
seven	Huangbai, Bixie	forty-five	nineteen	Coix seed, Poria cocos, Ox knee	thirty-five
eight	Tu Fu Ling, Bi Xie	forty-four	twenty	Coix seed, Poria cocos, Atractylodes macrocephala	thirty-five
nine	Huangbai, Niugeng	forty-four	twenty-one	Huangbai, Cangzhu, Bixie	thirty-four
ten	Coix seed, Huangbai, Cangzhu	forty-three	twenty-two	Coix seed, Poria cocos, Bixie	thirty-three
eleven	Poria cocos, Atractylodes macrocephala	forty-three	twenty-three	Coix seed, Poria cocos, Bixie	thirty-three
twelve	Coix seed, Bi Xie	forty-three			

Conduct a formula analysis on the included prescriptions, with a support score of 69 and a confidence level of 0.6. After conducting medication pattern analysis, 23 commonly used drug combinations were identified, including 6 traditional Chinese medicines. The drug combinations were ranked in descending order of frequency, as shown in Table 4; Based on the K-means algorithm for further mining and entropy clustering analysis, three core combinations were obtained, as shown in Table 5 and Figure 4; And conduct regression simulation, the results are shown in Figure 5; After being displayed on the network, the relationship diagram of the core drug is shown in Figure 6.

Table 5: Core drug combinations

serial number	Drug combination	frequency
one	Huangbai, Cangzhu, Coix seed, Achyranthes bidentata, Bixie,	fifty-eight
two	Poria cocos, Coix seed, Weilingxian, Atractylodes macrocephala, Achyranthes bidentata,	forty-three
three	Coix seed, licorice, Poria cocos, Bixie, Achyranthes bidentata	thirty-seven



Note: The three colors represent three different groups, and the number of points in each group represents the frequency of the formula appearing in the core combination. The closer it is to the regression curve, the closer it is to this type of core drug.

Figure 4: Cluster Analysis of Prescriptions (K-means Algorithm+Clustering) Figure 5: Cluster Analysis of Prescriptions (K-means Algorithm+Regression Simulation) Figure 6: Core drug association network diagram

3.1.5. Discuss

The Traditional Chinese Medicine Inheritance Assistance Platform (V3.0) is an integrated software for analyzing traditional Chinese medicine data, aimed at deeply exploring the wisdom in the field of traditional Chinese medicine. This software deeply integrates advanced technologies such as artificial intelligence, data mining, and network science. It revolves around four core themes of traditional Chinese medicine, namely inheritance, development, innovation, and promotion. Based on the characteristics of traditional Chinese medicine, it collects relevant literature or prescriptions for a certain disease, conducts in-depth research on medication patterns, understands key information such as commonly used drugs, drug combinations, and core drug combinations for treating specific diseases. It fully combines the unique theoretical system and clinical practice experience of traditional Chinese medicine, and constructs a system platform with data analysis as the core and highlighting the inheritance characteristics of traditional Chinese medicine. In recent years, the system has been increasingly widely used in traditional Chinese medicine data mining. For example, Wang Xueliang used the Traditional Chinese Medicine Inheritance Assistance Platform (V2.5) to conclude that traditional Chinese medicine treatment for gout mainly focuses on clearing heat and dampness, promoting blood circulation and unblocking collaterals to relieve pain, dispelling phlegm and stasis, and strengthening the spleen to remove dampness and turbidity. Based on specific disease conditions, the system combines attack and supplement, tonifying the liver and kidney, warming yang and unblocking collaterals, and nourishing yin. He also discovered 26 new prescriptions for treating gout^[16]. Hou Xiujuan et al. also conducted research on the medication patterns of traditional Chinese medicine in the treatment of rheumatoid arthritis based on this platform, and found that the main treatment method for rheumatoid arthritis is to warm the meridians, disperse cold, and clear the meridians. This provides new ideas and methods for the traditional Chinese medicine treatment of rheumatoid arthritis^[17].

This article uses the Traditional Chinese Medicine Inheritance Assistance Platform (V3.0) to conduct drug analysis on the literature on the diagnosis and treatment of AGA in traditional Chinese medicine that has been reviewed and sorted out in the past 10 years. It is concluded that the main type of AGA syndrome is damp heat accumulation type, and the treatment is based on cold drugs to clear heat and remove dampness, supplemented by both warm and mild drugs. The medicinal properties are mainly sweet, supplemented by bitter and pungent drugs, which can replenish warmth, dry dampness, and disperse bitterness, so as to dispel dampness without forgetting to supplement.

The top ten commonly used traditional Chinese medicines with a frequency of over 20 are Coix seed, Phellodendron bark, Poria cocos, Achyranthes bidentata, Atractylodes macrocephala, Bixie, Zexie, Weilingxian, Angelica sinensis, and Atractylodes macrocephala. Coix seed has the effects of promoting diuresis and dampness, strengthening the spleen and stopping diarrhea, removing dampness, expelling pus, detoxifying and dispersing nodules. Studies have shown that Coix seed extract can inhibit xanthine oxidase, regulate purine metabolism, and reduce the formation of urate crystals^[18]. Huangbai has the function of clearing heat and dampness, purging fire and detoxifying, and Jian Rui et al. have confirmed through experiments that the berberine component in Huangbai can lower the level of inflammatory factors and alleviate symptoms of gouty arthritis^[19]. Achyranthes bidentata has the effects of promoting blood circulation and meridians, tonifying liver and kidney, promoting diuresis and promoting diuresis, and inducing fire and descending function. Studies have shown that the main active ingredient of Achyranthes bidentata is total saponins of Achyranthes bidentata, which have anti-inflammatory and antioxidant effects^[20]. Tu Fu Ling can detoxify, diuretic, and promote joint function; Bi Xie has the effects of clearing turbidity and dampness, dispelling wind and Bi, and promoting diuresis and promoting diuresis. Research has shown that Tu Fu Ling and Bi Xie are essential medicines for treating acute gouty arthritis. The active ingredients of Tu Fu Ling can inhibit the expression of inflammatory factors and effectively alleviate inflammatory reactions; The total saponins of Bixie can regulate the expression of downstream inflammatory factors and alleviate the symptoms of acute gout attacks by inhibiting the

assembly of NALP3 inflammasome and activating caspase-1^{[21][22][23]}. *Atractylodes macrocephala* has the effects of invigorating the spleen and dampness, eliminating rheumatism, and improving eyesight. Its effective ingredients can inhibit the activity of xanthine oxidase and reduce uric acid production, making it a targeted drug for the treatment of HUA^{[24][25]}. *Zexie* has the effects of clearing heat, detoxifying turbidity, and lowering blood lipids, which can promote the excretion of uric acid^[26]. *Weilingxian* has the effects of dispelling wind and dampness, unblocking meridians, relieving pain, and eliminating bone blockages. Research has found that triterpenoid saponins in *Weilingxian* can inhibit cyclooxygenase-1 and cyclooxygenase-2, thereby reducing the formation of urate crystals^[27]. *Angelica sinensis* has the effects of nourishing blood, promoting blood circulation, regulating menstruation and relieving pain, and moistening the intestines and promoting bowel movements; *Atractylodes macrocephala* has the effects of invigorating the spleen, nourishing qi, drying dampness, and promoting diuresis. It can be seen that the main drugs for treating AGA are clearing heat and promoting dampness, strengthening the spleen and purging turbidity, and promoting blood circulation and dispersing stasis.

After analyzing the medication patterns based on association rules, 23 commonly used drug combinations were identified, including 6 traditional Chinese medicines, namely Huangbai, Tufu Ling, Cangzhu, Coix seed, Bixie, and Niuxi, which are mainly used for clearing heat and dampness, purging turbidity and removing Bi. The core combination medicine consists of three groups: Huangbai *Atractylodes Atractylodes Coix Seed Achyranthes Bidentata*, Tufu Ling Coix Seed Weiling Xian *Atractylodes Atractylodes Bidentata*, Coix Seed Licorice Tufu Ling Bixie *Achyranthes Bidentata*. This disease often presents as a syndrome of dampness and heat accumulation. Therefore, the treatment mainly focuses on clearing heat, diuresis, unblocking meridians, and relieving pain, supplemented by methods of invigorating the spleen and kidney.

In summary, this study delves into the medication patterns of traditional Chinese medicine in the treatment of AGA through data analysis. The main therapeutic principles of using medicinal materials such as Coix seed, Huangbai, Tufu Ling, *Achyranthes bidentata*, *Atractylodes macrocephala*, and Bixie are to clear heat and dampness, clear fire and detoxify, and remove blood stasis and unblock collaterals. At the same time, the treatment method is supplemented by tonifying the liver and kidney, regulating the spleen and stomach, aiming to strengthen the foundation and nourish the body, enhance the patient's physical fitness and disease resistance, reflecting the unique idea of traditional Chinese medicine that treats both symptoms and symptoms, and urgent symptoms. This study not only reveals to some extent the medication patterns of traditional Chinese medicine in the treatment of acute gouty arthritis, but also provides valuable reference and guidance for clinical medication. In the future, we can further study the mechanism of action of traditional Chinese medicine, optimize medication plans, improve treatment effectiveness, and provide more scientific and effective basis for the traditional Chinese medicine treatment of acute gouty arthritis.

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