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Exploration of the Medication Patterns of Chief Physician Qiao Shuzhen in Treating Liver-Yang Headache Based on Data Mining

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Abstract: ***Objective:*** ***To conduct data mining and analysis of the prescription medication characteristics of Shaanxi Provincial Distinguished TCM Physician Qiao Shuzhen in the treatment of liver-yang headache using the Traditional Chinese Medicine Inheritance Support System.*** ***Methods:*** ***Prescriptions for liver-yang headache cases treated by Dr. Qiao Shuzhen at Shaanxi Provincial Hospital of Traditional Chinese Medicine in 2020 were selected. Data mining and statistical analysis of medication patterns were performed using the Traditional Chinese Medicine Inheritance Support System (V2.5).*** ***Results:*** ***A total of 158 valid prescriptions were collected, involving 83 Chinese herbal medicines with a cumulative usage frequency of 2,762 times. Analysis showed that Chief Physician Qiao Shuzhen preferred herbs with neutral properties, among which sweet-flavored herbs were used most frequently, and the meridian entry was primarily the Heart meridian. The top 6 herbs by usage frequency were Curcumae Radix (Yujin), Glycyrrhizae Radix et Rhizoma (Gancao), Gastrodiae Rhizoma (Tianma), Cyperi Rhizoma (Xiangfu), Chuanxiong Rhizoma (Chuanxiong), and Polygalae Radix (Yuanzhi).*** ***Conclusion:*** ***Chief Physician Qiao Shuzhen's treatment of liver-yang headache centers on regulating qi movement, emphasizing the coordination of the five zang-organs with a focus on soothing the liver, combined with psychological adjustment. The high-frequency herb combinations summarized in this study not only reflect her clinical characteristics in treating liver-yang headache but also provide a reference for the pattern differentiation and treatment of dizziness, emotional disorders, and sleep disturbances caused by liver-yang hyperactivity, thereby expanding the clinical diagnostic and therapeutic approach to liver-yang headache.***

Keywords: Traditional Chinese Medicine Inheritance Support Platform, Qiao Shuzhen, Liver-yang headache, Medication patterns.

1. Introduction

Headache is a common neurological disorder that frequently comorbid with depression, anxiety, and sleep disorders. It ranks second among neurological disorders in terms of disability, carrying a heavy disease burden and high incidence [1]. An analysis based on 2019 Global Burden of Disease (GBD) data showed that globally, the incidence, prevalence, and disability-adjusted life years (DALYs) of headache have all shown an upward trend with fluctuations [2].

The Huangdi Neijing (Yellow Emperor's Inner Canon) classifies headache into two major categories: exterior contraction and internal injury. Liver-yang headache is one of the common patterns of internal injury headache, characterized by bilateral mild to moderate pressure-like or band-like non-pulsating headache. The basic pathogenesis of headache can be summarized as: pain due to obstruction, and pain due to lack of nourishment.

The etiology and pathogenesis of liver-yang headache mainly include: chronic work and life stress, prolonged mental tension and melancholy, emotional depression and anger, liver failing to maintain its free flow, qi stagnation and yang hyperactivity; or liver stagnation transforming into fire, yang hyperactivity generating fire that upwardly disturbs the orifices of the head, resulting in headache; or wood fire damaging yin, kidney water insufficiency, water failing to nourish wood, leading to liver-yang hyperactivity that upwardly disturbs the clear orifices and causes headache.

Currently, for the clinical treatment of mild to moderate headache, Western medicine guidelines recommend non-steroidal anti-inflammatory drugs (NSAIDs) or acetaminophen as first-line conventional analgesics. For patients with severe symptoms or poor response to the above medications, combination preparations containing caffeine or specific antimigraine drugs (such as triptans) may be considered. However, clinical practice shows that improper use or long-term administration of these drugs can easily cause various adverse drug reactions. More importantly, existing Western therapies still have the limitation of insufficient targeting in the field of headache treatment [12]. Chinese herbal medicine, with its unique diagnostic and therapeutic characteristics, when combined with Western medicine in treating liver-yang headache, can achieve lower costs and fewer adverse reactions [8] [9].

Shaanxi Provincial Distinguished TCM Physician Chief Physician Qiao Shuzhen, based on long-term clinical experience, has found that liver-yang headache has the highest incidence among clinical headache cases. Therefore, starting from the etiology, accurate pattern differentiation is performed to leverage the advantages of traditional Chinese medicine. The clinical prescriptions used have the effects of pacifying liver and extinguishing wind, unblocking collaterals and alleviating pain, and calming the spirit and settling the mind, so as to provide symptomatic treatment for patients with liver-yang headache, relieve symptoms, and improve clinical efficacy. Using the Traditional Chinese Medicine Inheritance Support Platform (V2.5), data mining methods were applied to analyze the medication patterns of Chief Physician Qiao Shuzhen in the clinical treatment of liver-yang headache, with the aim of providing more TCM references for the clinical diagnosis and treatment of liver-yang headache.

2. Materials and Methods

2.1 Prescription Selection

TCM prescriptions for patients with liver-yang headache treated by Chief Physician Qiao Shuzhen at the outpatient department of Shaanxi Provincial Hospital of Traditional Chinese Medicine from January 2020 to December 2020 were collected.

2.2 Inclusion and Exclusion Criteria

2.2.1 Inclusion Criteria

Cases meeting the diagnostic criteria for liver-yang headache in Internal Medicine of Traditional Chinese Medicine [3], with complete prescription data, clear TCM pattern, therapeutic method, and herbal composition; prescriptions primarily intended for treating liver-yang headache; and cases assessed as cured or improved according to the Diagnostic and Therapeutic Effect Standards for TCM Diseases and Syndromes [5].

2.2.2 Exclusion Criteria

Cases not meeting the inclusion criteria; dropout cases; and cases complicated with severe underlying diseases or mental disorders.

2.3 Database Establishment and Data Verification

Referring to the Pharmacopoeia of the People's Republic of China [6], the Chinese herbal medicines in the prescriptions were standardized. The screened prescriptions were entered into the Traditional Chinese Medicine Inheritance Support Platform (V2.5) (provided by the Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences) by two personnel. Dedicated personnel entered the prescriptions one by one, and after completion, another person was responsible for data verification to ensure data accuracy. A database of Chief Physician Qiao Shuzhen's prescriptions for liver-yang headache was thereby established.

2.4 Data Analysis

After database entry was completed, statistical analysis was performed on the entered data using the "Prescription Analysis," "Statistical Report System," and "Data System" functions of the software. The frequency of herb use was counted, and the usage of high-frequency herbs was analyzed, sorted in descending order, and the results were exported.

For prescription pattern analysis, the support degree was set at ≥135 occurrences and confidence at ≥0.95. High-frequency herb pairs were used to highlight the core structure of Chief Physician Qiao Shuzhen's prescriptions, common herb pairs and core combinations were extracted, and association rule analysis was applied to examine the correlation coefficients between herbs.

3. Results

3.1 Statistics on the Four Qi, Five Flavors, and Meridian Entries of the Herbs Used

Among the 158 prescriptions counted, a total of 83 medicinal herbs were involved, with a cumulative usage frequency of 2,762 times.

Analysis of the four qi (properties) of the herbs showed that neutral herbs were used most frequently, at 994 times, accounting for 38.51% of the total; followed by warm herbs at 818 times, accounting for 31.69%; cold herbs ranked third, appearing 633 times, accounting for 24.53%; cool herbs appeared 136 times, accounting for 5.27%.

Statistics on the five flavors showed that, in descending order of usage frequency: sweet, bitter, pungent, salty, sour, and astringent. The top three flavors predominated, accounting for 31.12%, 29.77%, and 29.70% respectively (see Table 2).

Analysis of meridian entries showed that five meridians had usage frequencies exceeding 10%, namely: Heart, Liver, Spleen, Stomach, and Lung (see Table 3).

Table 1: Distribution of Four Qi (Properties) of the Herbs Used

Rank	Four Qi	Frequency (times)	Percentage (%)
1	Neutral	994	38.51
2	Warm	818	31.69
3	Cold	633	24.53
4	Cool	136	5.27
5	Hot	0	0.00

Table 2: Distribution of Five Flavors of the Herbs Used

Rank	Five Flavors	Frequency (times)	Percentage (%)
1	Sweet	1292	31.12
2	Bitter	1236	29.77
3	Pungent	1233	29.70
4	Salty	178	4.29
5	Sour	134	3.23
6	Astringent	79	1.90

Table 3: Distribution of Meridian Entries of the Herbs Used

Rank	Meridian Entry	Frequency (times)	Percentage (%)
1	Heart	1392	19.11
2	Liver	1336	18.34
3	Spleen	1079	14.81
4	Stomach	973	13.35
5	Lung	803	11.02
6	Gallbladder	573	7.86
7	Kidney	462	6.34
8	Large Intestine	302	4.14
9	Small Intestine	155	2.13
10	Sanjiao	143	1.96
11	Pericardium	40	0.55
12	Bladder	28	0.38

3.2 Herb Usage Frequency

Based on the statistics of herb usage frequency, herbs used more than 70 times were selected as high-frequency herbs, totaling 19 herbs. The top 10 were: Curcumae Radix (Yujin, 151 times), Glycyrrhizae Radix et Rhizoma (Gancao, 150 times), Gastrodiae Rhizoma (Tianma, 147 times), Cyperi Rhizoma (Xiangfu, 143 times), Chuanxiong Rhizoma (Chuanxiong, 143 times), Polygalae Radix (Yuanzhi, 138 times), Acori Tatarinowii Rhizoma (Shichangpu, 133 times), Puerariae Lobatae Radix (Gegen, 133 times), Scutellariae Radix (Huangqin, 123 times), and Poria cum Pini Radis (Fushen, 118 times).

Among them, the high-frequency herbs, classified by efficacy, mainly included: (1) Liver-calming and wind-extinguishing herbs: Gastrodiae Rhizoma (Tianma), Bombyx Batryticatus (Jiangcan); (2) Blood-activating and stasis-resolving herbs: Curcumae Radix (Yujin), Chuanxiong Rhizoma (Chuanxiong), Corydalis Rhizoma (Yanhusuo); (3) Spirit-calming herbs: Polygalae Radix (Yuanzhi), Platycladi Semen (Baiziren), Polygoni Multiflori Caulis (Shouwuteng), Albiziae Cortex (Hehuanpi), Draconis Os (Longgu), Ostreae Concha (Muli); (4) Deficiency-supplementing herbs: Glycyrrhizae Radix et Rhizoma (Gancao), Atractylodis Macrocephalae Rhizoma (Baizhu), Paeoniae Alba Radix (Baishao). See Table 4 for details.

Table 4: Distribution of High-Frequency Herb Usage (Frequency > 50, n = 126)

Rank	Herb	Frequency	Percentage (%)	Rank	Herb	Frequency	Percentage (%)
1	Yujin	151	95.57	11	Baizhu	116	73.42
2	Gancao	150	94.94	12	Baiziren	115	72.78
3	Tianma	147	93.04	13	Yanhusuo	104	65.82
4	Xiangfu	143	90.51	14	Shouwuteng	99	62.66
5	Chuanxiong	143	90.51	15	Jiangcan	99	62.66
6	Yuanzhi	138	87.34	16	Hehuanpi	84	53.16
7	Shichangpu	133	84.18	17	Longgu	73	46.20
8	Gegen	133	84.18	18	Baishao	72	45.57
9	Huangqin	123	77.85	19	Muli	70	44.30
10	Fushen	118	74.68				

3.3 Analysis of Prescription Patterns Based on Association Rules

Based on association rule analysis of prescription patterns, with support set at 135 occurrences and confidence at 0.95, 16 herb combinations were obtained. Sorted in descending order of frequency, the top 3 herb combinations were: Yujin-Gancao (145 times), Yujin-Tianma (145 times), and Yujin-Xiangfu (143 times). See Table 5 for details. Association rule analysis was performed on the prescription herbs; the resulting herb combinations are shown in Table 6, and the prescription network graph is shown in Figure 1.

Table 5: Usage of Herb Combinations (Support ≥ 135, n = 158)

Rank	Herb Combination	Frequency (times)	Percentage (%)
1	Yujin, Gancao	145	91.77
2	Yujin, Tianma	145	91.77
3	Yujin, Xiangfu	143	90.51
4	Gancao, Tianma	141	89.24
5	Chuanxiong, Yujin	139	87.97
6	Chuanxiong, Tianma	139	87.97
7	Yujin, Gancao, Tianma	139	87.97
8	Yujin, Yuanzhi	138	87.34
9	Gancao, Xiangfu	138	87.34
10	Xiangfu, Tianma	138	87.34
11	Yujin, Gancao, Xiangfu	138	87.34
12	Yujin, Xiangfu, Tianma	138	87.34
13	Chuanxiong, Yujin, Tianma	137	86.71
14	Chuanxiong, Gancao	136	86.08
15	Chuanxiong, Xiangfu	135	85.44
16	Chuanxiong, Yujin, Xiangfu	135	85.44

Table 6: Association Rules of Herbs (Confidence ≥ 0.95, Top 10)

Rank	Herb Pair (Antecedent → Consequent)	Confidence
1	Xiangfu → Yujin	1.0000
2	Yuanzhi → Yujin	1.0000
3	Gancao, Xiangfu → Yujin	1.0000
4	Xiangfu, Tianma → Yujin	1.0000
5	Tianma → Yujin	0.9864
6	Gancao, Tianma → Yujin	0.9858
7	Chuanxiong, Tianma → Yujin	0.9856
8	Chuanxiong, Yujin → Tianma	0.9856
9	Chuanxiong → Yujin	0.9720
10	Chuanxiong → Tianma	0.9720

4. Discussion

During nearly 40 years of clinical practice, Chief Physician Qiao Shuzhen, based on long-term clinical experience, has found that liver-yang headache has the highest incidence. Combining the clinical characteristics of common headache patients and their associated symptoms, she has repeatedly optimized her clinical prescriptions. The prescriptions used have the effects of pacifying liver and extinguishing wind, unblocking collaterals and alleviating pain, and calming the spirit and settling the mind. They are mainly indicated for liver-yang headache caused by liver-kidney yin deficiency, liver-yang transforming into wind, and upward disturbance of the brain orifices, with symptoms such as headache with distension, irritability and easy anger, restlessness and insomnia, red eyes, bitter mouth, flushing face, and dry mouth. The following analysis will discuss the efficacy, properties, and flavors of the herbs and herb pairs used in the clinical prescriptions based on the aforementioned data mining results.

4.1 Analysis of Herb Efficacy

This study analyzed the medication patterns of 158 TCM prescriptions for patients with liver-yang headache. The top four categories by usage frequency were: liver-calming and wind-extinguishing herbs, blood-activating and stasis-resolving herbs, spirit-calming herbs, and deficiency-supplementing herbs. The high-frequency herbs are consistent with Chief Physician Qiao Shuzhen's clinical approach of favoring liver-calming and wind-extinguishing herbs and blood-activating and stasis-resolving herbs in the treatment of liver-yang headache.

The etiology of liver-yang headache may involve emotional frustration, liver failing to maintain its free flow, stagnation transforming into fire that upwardly disturbs the clear orifices, commonly presenting as headache with distension; or liver-kidney yin deficiency, liver lacking nourishment, water failing to nourish wood, and liver-yang hyperactivity, commonly presenting as headache with dizziness. Therefore, liver-calming and wind-extinguishing herbs are selected for their effects of pacifying liver-yang and extinguishing wind to stop spasms, supplemented by blood-activating and stasis-resolving herbs, spirit-calming herbs, and deficiency-supplementing herbs. The overall combination

achieves the clinical efficacy of pacifying liver-yang, activating blood and resolving stasis to alleviate pain, while also calming the spirit and supplementing deficiency without damaging the healthy qi.

Among liver-calming and wind-extinguishing herbs, Gastrodiae Rhizoma (Tianma) is commonly selected. Tianma [19] enters the Liver meridian; it is neutral in property and sweet in flavor, with the effects of extinguishing wind and stopping spasms, pacifying liver-yang, and dispelling wind and unblocking collaterals. Its main indications cover neurological disorders such as infantile convulsion, epileptic seizures, and tetanus. In addition, it has significant therapeutic effects on a series of symptoms caused by liver-yang hyperactivity, including headache, dizziness, impaired movement of hands and feet, and limb numbness.

Related studies [20] have shown that the chemical components in Gastrodiae Rhizoma have significant protective effects on nerve cells. Studies by Yan Yu et al. [16] have shown that gastrodin extracted from Gastrodiae Rhizoma can effectively reduce the frequency of headache attacks, with rapid onset and no obvious adverse reactions. Related studies [21] [22] have shown that the chemical components in gastrodin can regulate nerve cells and signaling pathways in brain tissue, thereby significantly improving sleep in mice. Related studies have also found that the active components in Gastrodiae Rhizoma extract have sedative and hypnotic effects on the central nervous system, manifested as prolonged sleep time and reduced activity in mice.

Among blood-activating and stasis-resolving herbs, Curcumae Radix (Yujin) is commonly used. Related studies [14] have shown that Yujin may exert analgesic effects by regulating key targets through potential active components such as quercetin, curcumin, β-sitosterol, (E,Z)-farnesol, and oleic acid. Among spirit-calming herbs, Polygalae Radix (Yuanzhi) is commonly used. Related studies [17] have shown that Yuanzhi has a certain protective effect on the cardiovascular and cerebrovascular systems; its extract contains potent antidepressant activity with no obvious adverse reactions.

These effects reflect that in the clinical diagnosis and treatment of liver-yang headache, Chief Physician Qiao Shuzhen not only focuses on selecting prescriptions and herbs according to meridian localization, but also addresses commonly accompanying symptoms such as irritability, restlessness, and insomnia by using herbs such as Gastrodiae Rhizoma (Tianma) and Curcumae Radix (Yujin), in order to achieve the clinical efficacy of pacifying liver and extinguishing wind, unblocking collaterals and alleviating pain, and calming the spirit and settling the mind.

4.2 Analysis of Herb Properties and Flavors

Statistical results on the frequency of properties, flavors, and meridian entries in Chief Physician Qiao Shuzhen's clinical use of Chinese herbs showed that the top three flavors were "sweet, bitter, pungent"; the top three properties were "neutral, warm, cold"; and the top three meridian entries were Heart, Liver, and Spleen meridians.

In TCM theory, the "sweet" flavor has the effects of nourishing, harmonizing, and moderating; in clinical application, it is used for its functions of nourishing and supplementing deficiency, and relieving pain. Deficiency-supplementing herbs are mostly "sweet" in flavor; sweet enters the Spleen meridian, thereby achieving the effect of supplementing the spleen. In TCM theory, there is the saying: "When seeing liver disease, one knows the liver will transmit to the spleen." Therefore, while supplementing the spleen, it also achieves the clinical effect of soothing the liver.

Liver-calming and wind-extinguishing herbs are mostly "neutral" or "cold" in property, "sweet, bitter, pungent" in flavor, and mainly enter the Liver meridian, thereby achieving targeted effects on the liver. Liver-yang headache is mostly caused by liver failing to maintain its free flow, leading to counterflow of qi movement that disturbs the clear orifices and causes headache. Liver-calming and wind-extinguishing herbs, with their "neutral" property and "sweet" flavor, achieve the effect of pacifying liver-yang and soothing the liver; with their "cold" property and "bitter" flavor, they achieve the effect of clearing the heart and opening the orifices, cooling the liver and extinguishing wind.

Blood-activating and stasis-resolving herbs are mostly "pungent" in flavor and "warm" in property. In TCM theory, the "pungent" flavor has the effects of dispersing, moving qi, and moving blood; the "warm" property has the function of activating blood. Liver-yang headache is mostly caused by abnormal movement and transformation of qi and blood, leading to headache. Blood-activating and stasis-resolving herbs are used to move qi and activate blood, regulate and smooth qi movement, and normalize blood circulation. The combination of "pungent and bitter" achieves the effect of pungent-dispersing and bitter-down bearing, thereby balancing yin and yang [9].

Therefore, in the clinical diagnosis and treatment of liver-yang headache, Chief Physician Qiao Shuzhen frequently uses such herbs in her prescriptions to achieve the clinical efficacy of regulating qi movement and addressing all five zang-organs. Studies [15] have shown that Gastrodiae Rhizoma (Tianma), among the high-frequency herbs, treats headache due to its pungent-dispersing action "from the interior to the exterior," combined with its effects of dispelling wind and unblocking collaterals, moving qi and resolving phlegm, thereby achieving the therapeutic goal. Therefore, the use of Tianma for treating head wind is consistent with its "pungent" nature.

4.3 Analysis of Herb Pair Prescriptions

Based on association rule analysis of prescription patterns, it was found that in the clinical diagnosis and treatment of liver-yang headache, Chief Physician Qiao Shuzhen often combines Curcumae Radix (Yujin) with wind-extinguishing and spasm-stopping herbs, qi-regulating herbs, and blood-activating and pain-alleviating herbs. Common herb pairs include "Yujin-Tianma," "Yujin-Xiangfu," and "Yujin-Chuanxiong."

Related studies [18] have shown that curcumin, one of the

most important chemical components of Curcumae Radix (Yujin), has significant effects in antioxidant and anti-inflammatory activities, and has improving effects on mental cognition.

In the "Yujin-Tianma" herb pair, Gastrodiae Rhizoma (Tianma) is sweet and neutral in property, enters the Liver meridian, and has the effects of pacifying liver and extinguishing wind, and unblocking collaterals and alleviating pain. When the two herbs are combined, they jointly achieve the effect of soothing the liver and moving qi, enabling targeted treatment of liver-yang headache. Related studies have shown that Gastrodiae Rhizoma (Tianma) has analgesic effects [11], and corresponding studies have indicated [12] that Tianma primarily enters the Liver meridian and has a certain targeted therapeutic effect on liver-yang headache.

In the "Yujin-Xiangfu" herb pair, Cyperi Rhizoma (Xiangfu) is pungent, slightly bitter, and slightly sweet in flavor, neutral in property, and enters the Liver, Spleen, and Sanjiao meridians, with the effects of soothing the liver and relieving depression, and regulating qi and alleviating pain. When the two herbs are combined, their effects of soothing the liver, regulating qi, and relieving depression are enhanced.

The compatibility characteristics of the herbs are consistent with the etiology, pathogenesis, and therapeutic methods of liver-yang headache. Chief Physician Qiao Shuzhen believes that in treating liver-yang headache, the liver should be the primary focus, while also paying attention to the influence of psychological factors on the disease pattern itself in the etiology and pathogenesis of liver-yang headache.

5. Summary

Through data mining analysis, this study found that in the clinical diagnosis and treatment of liver-yang headache, Chief Physician Qiao Shuzhen takes regulating qi movement as the starting point, and is skilled in using liver-calming and wind-extinguishing herbs, blood-activating and stasis-resolving herbs, spirit-calming herbs, and deficiency-supplementing herbs. In the medication treatment of liver-yang headache, she emphasizes herb compatibility, pattern differentiation and treatment, focusing on the liver while paying attention to psychological intervention, effectively carrying out clinical treatment of liver-yang headache.

This provides a new reference for the clinical diagnosis and treatment of liver-yang headache, and offers a reference for future generations regarding the medication experience for liver-yang headache and the inheritance of renowned physicians.

Due to limitations in manpower, time, and other conditions, this mining study only selected outpatient prescriptions from one year as research indicators. In the future, we will continue to study the medication patterns of Chief Physician Qiao Shuzhen in the clinical diagnosis and treatment of liver-yang headache, organize and summarize related medical records, and provide new ideas and references for future clinical treatment of liver-yang headache.

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