Correlation study of Ban Xia tang prescriptions in Dun Huang and ancient medical literature

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Abstract: Abstract It discusses the pertinences of Ban Xia Decoction in Dunhuang's prescriptions and combinations of the same name in ancient medical books. Prescriptions of the same name in different eras and cited in medical count repeatedly. The name of ancient books don' t count repeatedly. We searched the Rhizoma Pinelliae Decoction of official or variant name in 60 ancient medical books in the Western Han Dynasty, Zhou Dynasty, Eastern Jin Dynasty ,Northern and   Southern Dynasty, Northern Zhou Dynasty, Tang Dynasty, Song Dynasty, Yuan Dynasty, Ming Dynasty and Qing Dynasty that include 169 prescriptions about Ban Xia Decoction.49 ancient medical books of 60 ancient medical books recorded 145 prescriptions of Ban Xia Decoction of the official name.14 ancient medical books of 60 ancient medical books recorded 24 prescriptions of Ban Xia Decoction of variant name. It clears up 125 prescriptions of Ban Xia Decoction in different combinations which involves 107 kind of herbs divided into 4 categories. A kind of medicine used 886 times in these prescriptions. Through analyzing the combinations of Ban Xia Decoction of successive dynasties, there are 3 discoveries: first, the central herbs of Ban Xia Decoction of successive dynasties are Ban Xia, Ginger, Radix Glycyrhizae, Ginseng, Cinnamon, Poria Cocos, Pericarpium Citri Reticulatae, Rhizoma Atractylodies Macrocephalae which are also used in two typical prescriptions Four Ingredient Decoction for Spleen Qi Deficiency and Er Chen Decoction. Second, Ban Xia Decoction of Ancient medical prescriptions on Dunhuang composed of4 central drugs——Ban Xia, Ginger, Poria Cocos, Pericarpium Citri Reticulatae added Evodia. These are all main drugs because of frequency averagely exceeds 1.0%. Third, Rhizoma Pinelliae Decoction of Dunhuang's prescriptions maybe is the modification of prescriptions of Rhizoma Pinelliae Decoction of variant name which composes of Rhizoma Pinelliae and Ginger in Jin Gui Yao Lue.

Keywords: Dunhuang ancient medical prescriptions, historical medical literature, Ban Xia Tang homonymous formulas, prescription compatibility, correlation study

1. Introduction

Before the Qing Dynasty, there were many instances of the same-name Ban Xia Tang in the Dunhuang ancient medical prescriptions and ancient medical literature [1-3]. Most of them have the effects of eliminating phlegm, reducing counterflow, strengthening the spleen, and harmonizing the stomach, but their prescription compositions and main indications vary. A database of Ban Xia Tang prescriptions was established for those appearing in ancient books before the Qing Dynasty, and the medicines used were classified and statistically analyzed according to the classification standards of "The Great Dictionary of Chinese Medicine"[4] and "Chinese Medicine"[5]. In the study, statistical methods were used: the frequency of use = cumulative frequency / total frequency × 100%; cumulative frequency = the sum of the same efficacy frequency; average frequency = cumulative frequency / number of flavors, reflecting the concentration of medicine use. Data mining analysis was conducted on the frequency and frequency of its medicine classification, four qi and five flavors, and meridian tropism, in order to explore the correlation of medicine use and the system of prescription compatibility rules in Ban Xia Tang in Dunhuang and ancient medical literature, and to provide new ideas for the development of new drugs for the treatment of phlegm-damp cough diseases using Dunhuang prescription Ban Xia Tang.

2. Frequency analysis of Ban Xia Tang medicinal herbs

By statistically analyzing the 107 kinds of traditional Chinese medicinal herbs involved in 125 Ban Xia Tang prescriptions from before the Qing Dynasty, the highest frequency was 14.11%, and the lowest was 0.11%. Among them, 2 herbs (1.87%) had a usage frequency of ≥10.0%; 2 herbs (1.87%) had a frequency between 5.0% and 6.0%; 4 herbs (3.74%) had a frequency between 3.0% and 5.0%; 16 herbs (14.95%) had a frequency between 1.0% and 3.0%; 12 herbs (11.21%) had a frequency between 0.5% and 1.0%; 71 Chinese medicinal herbs (66.36%) had a usage frequency <0.5%. The distribution is shown in Table 1.

Table 1: Frequency Statistics of Chinese Medicinal Herbs Used in 125 Ban Xia Tang Prescriptions

Serial No.	Chinese Medicinal Herb	Frequency	Frequency (%)	Number of Tastes (%)
1	Pinellia (Ban Xia)	125	14.11	1 (0.93)
2	Ginger (Sheng Jiang)	95	10.72	1 (0.93)
3	Licorice (Gan Cao)	54	6.09	1 (0.93)
4	Ginseng (Ren Shen)	45	5.08	1 (0.93)
5	Cinnamon (Gui Zhu)	40	4.51	1 (0.93)
6	Poria (Fu Ling)	39	4.40	1 (0.93)
7	Tangerine Peel (Chen Pi)	35	3.95	1 (0.93)
8	Atractylodes (Bai Zhu)	30	3.39	1 (0.93)
9	Jujube (Da Zao)	20	2.26	1 (0.93)
10	Scutellaria (Huang Qin), Dried Ginger (Gan Jiang)	19	2.14	2 (1.87)
11	Asarum (Xi Xin), Red Poria (Chi Fu Ling), Peucedanum (Qian Hu), Almond (Xing Ren)	14	1.58	4 (3.74)
12	Bitter Orange (Zhi Ke), Platycodon (Jie Geng), Oat (Mai Men Dong)	13	1.47	3 (2.80)
13	Aconite (Fu Zi)	11	1.24	1 (0.93)
14	Magnolia Bark (Hou Po), Evodia (Wu Zhu Yu), Platycodon (Jie Geng), Angelica (Dang Gui)	10	1.13	4 (3.74)
15	White Peony (Bai Shao Yao)	9	1.02	1 (0.93)
16	Ephedra (Ma Huang), Aurantium (Zhi Shi), Glutinous Rice (Nuo Mi)	8	0.90	3 (2.80)
17	Bupleurum (Chai Hu), Rehmannia (Sheng Di Huang)	7	0.79	2 (1.87)
18	Lithospermum (Shi Qing), Bamboo Leaf (Zhu Ye), Inula (Xuan Fu Hua), Polygala (Yuan Zhi), Jujube Seed (Suan Zao Ren)	6	0.68	5 (4.67)
19	Ligusticum (Chuan Xiong), Mulberry Bark (Sang Bai Pi)	5	0.56	2 (1.87)
20	Cinnamon Twig (Gui Zhi), Alisma (Ze Xie), Clove (Ding Xiang), Gleditsia Thorn (Zao Jiao Ci), Purple Herb (Zi Huang), Floating Wheat (Fu Xiao Mai)	4	0.45	6 (5.61)
21	Kudzu (Ge Gen), Gardenia (Zhi Zi), Reed Rhizome (Lu Gen), Amomum (Sha Ren), Akebia (Mu Tong), Red Bean (Chi Xiao Dou), Aucklandia (Mu Xiang), Trichosanthes (Gua Lou), Fritillaria (Chuan Bei Mu), Bamboo Shavings (Zhu Ru), Platycodon (Jie Geng), Asparagus (Tu Bei Mu), Astragalus (Huang Qi), Rice (Jing Mi), Honey (Feng Mi), Donkey-hide Gelatin (E Jiao), Black Dates (Wu Mei)	3	0.34	16 (14.95)
22	Saposhnikovia (Fang Feng), Perilla (Zi Su), Coptis (Huang Lian), Belamcanda (She Gan), Tangerine Peel (Qing Pi), Large-leafed Atractylodes (Da Fu Pi), Peach Kernel (Tao Ren), Antelope Horn (Ling Yang Jiao), Lily Bulb (Bai He), Terminalia (He Zi)	2	0.23	11 (10.28)

| 23 | Angelica (Bai Zhi), Notopterygium (Qiang Huo), Mint (Bo He), Cimicifuga (Sheng Ma), Onion (Cong Bai), Mulberry Leaf (Sang Ye), etc. | 1 | 0.11 | 38 (35.51) |

According to Table 1, there are 36 types of Chinese medicinal herbs with a usage frequency greater than 0.5% among the 125 prescriptions, accumulating a total of 754 uses. This accounts for 33.64% of the total 107 types of herbs used and 64.79% of the total frequency of 886, with a cumulative frequency of 85.10%. These herbs are the main medicines used in clinical treatment. The highest usage frequency is for Pinellia (14.11%), followed by Ginger (10.72%), making them high-frequency herbs in clinical diagnosis and treatment. The core herbs include Pinellia, Ginger, Licorice, Ginseng, Cinnamon, Poria, Tangerine Peel, and Atractylodes, which are the preferred choices for treating phlegm-damp cough in clinical practice.

3. Efficacy analysis of Ban Xia Tang herbs

A statistical analysis of the efficacy of the 107 Chinese medicinal herbs involved in 125 prescriptions is described in terms of the number of tastes, average frequency, usage rate, and cumulative frequency. The 107 herbs are categorized into 16 classes, and their distribution is presented in Table 2.

Table 2: Statistical Table of Medicinal Efficacies Used in 125 Ban Xia Tang Prescriptions

Efficacy Category	Number of Chinese Medicinal Herbs	Original Cumulative Frequency	Average Frequency	Usage Frequency (%)
Tonifying Medicine	14	204	14.57	23.02
Expectorant and cough-relieving medicine	16	195	12.19	22.01
External-resolving medicine	14	141	10.07	15.91
Warmer	7	86	12.29	9.71
Qi-regulating medicine	9	69	7.67	7.79
Diuretic and dampness-reducing medicine	9	68	7.56	7.67
Heat-clearing medicine	13	53	4.08	5.98
Dampness-transforming medicine	4	15	3.75	1.69
Antiparasitic medicine	1	13	13.00	1.48
Sedative	2	12	6.00	1.36
Astringent medicine	6	12	2.00	1.35
Blood-activating and stasis-removing medicine	3	8	2.67	0.90
Laxative	5	5	1.00	0.56
Digestant	2	2	1.00	0.23
Liver-calming and wind-extinguishing medicine	1	2	2.00	0.23
Wind-dampness-dispelling medicine	1	1	1.00	0.11

According to Table 2, it can be shown that the cumulative frequency of the top 3 efficacy categories of medicines is 540 times, accounting for 60.95% of the total frequency of 886 times. The first is tonifying medicine (23.02%) with the highest usage frequency, followed by expectorant and cough-relieving medicine (22.01%), and then external-resolving medicine (15.91%). The usage frequency of these 3 categories of medicines is relatively high, and they are the basic categories of medicines for the clinical differentiation and treatment of cough and phlegm-dampness diseases. Although the frequency of use of warming interior medicine is not high, the average frequency is relatively high at 12.29, reflecting the therapeutic idea of warming and transforming cold phlegm, and serves as an auxiliary and enhancing category of medicine in treatment.

4. Frequency and efficacy of Ban Xia Tang herbs in literature

Based on Table 3, it can be demonstrated that: The highest usage frequency is for pungent medicinal herbs, followed by sweet and bitter tastes. The cumulative usage frequency of these three tastes is 1235 times, accounting for 91.08% of the total frequency of 1356, indicating that the treatment mainly relies on sweet, pungent, and bitter medicinal herbs. Although the usage frequency of bland medicinal herbs is not high, the average frequency is the highest at 18.00, while the average frequency of astringent medicinal herbs is the lowest at 0.44. Warm natured medicinal herbs have the highest usage frequency, followed by neutral and cold natured herbs. The cumulative frequency of these three types of medicinal herbs is 787 times, accounting for 89.74% of the total frequency of 877 times. Although the usage frequency of hot natured medicinal herbs is not high, the average frequency is the highest at 16.20, reflecting the traditional Chinese medical concept of warming and transforming cold phlegm in treatment.

5. Ban Xia Tang herb frequency and efficacy analysis

The statistics of 125 prescriptions are described in terms of the number of medicinal tastes, cumulative frequency, average frequency, and usage frequency. A total of 107 kinds of traditional Chinese medicinal herbs involved in the 125 compound prescriptions were statistically analyzed for their meridian tropism, and their distribution is shown in Table 4.

Table 3: Statistical Table of Medicinal Efficacies Used in 125 Ban Xia Tang Prescriptions

Taste	Number of Chinese Medicinal Herbs	Cumulative Frequency	Average Frequency	Usage Frequency (%)
Spicy	54	527	9.76	38.86
Sweet	47	395	8.40	29.13
Bitter	49	313	6.39	23.08
Light	3	54	18.00	3.99
Sour	8	45	5.63	3.32
Astringent	8	16	2.00	1.18
Astringent	3	6	2.00	0.44
Warm	44	459	10.43	52.34
Neutral	18	193	10.72	22.01
Cold	34	135	3.97	15.38
Mild	5	81	16.2	9.24

Cool	4	9	2.25	1.03

Table 4: Statistical Table of Meridian Tropism of Medicinal Herbs Used in 125 Ban Xia Tang Prescriptions

Meridian Tropism	Number of Chinese Medicinal Herbs	Cumulative Frequency	Average Frequency	Usage Frequency (%)
Spleen	47	662	14.09	25.29
Lung	53	573	10.81	21.89
Stomach	49	512	10.45	19.56
Heart	28	316	11.29	12.07
Kidney	23	172	7.48	6.57
Liver	29	126	4.34	4.81
Large Intestine	23	94	4.09	3.58
Gallbladder	8	45	5.63	1.72
Triple Burner	2	43	21.50	1.64
Bladder	11	40	3.64	1.53
Small Intestine	6	34	5.67	1.30
Pericardium	-	-	-	0.04

According to Table 4, it can be demonstrated that the meridian tropism of the medicines is primarily focused on the Spleen, Lung, and Stomach, with a cumulative usage frequency of 1747 times, accounting for 66.73% of the total 2618 times of medication use. Although the usage frequency of the Triple Burner meridian is not high, it has the highest average frequency at 21.50, indicating that the clinical treatment emphasizes the selection of medicines associated with the Triple Burner meridian.

6. Conclusion

Through the use of data mining methods to analyze the patterns of prescription compatibility in Ban Xia Tang from Dunhuang and ancient medical literature, the following conclusions can be drawn: The core ingredients of Ban Xia Tang throughout the ages are Pinellia (Ban Xia), Ginger (Sheng Jiang), Licorice (Gan Cao), Ginseng (Ren Shen), Cinnamon (Gui Zhu), Poria (Fu Ling), Tangerine Peel (Chen Pi), and Atractylodes (Bai Zhu), among others. The main categories of these core herbs are tonifying medicine, expectorant and cough-relief medicine, and exterior-resolving medicine. The Ban Xia Tang in the Dunhuang ancient medical prescriptions is composed of four core ingredients—Pinellia, Ginger, Poria, and Tangerine Peel—plus Evodia (Wu Zhu Yu), all of which are main drugs with a frequency greater than 1.0%. The Ban Xia Tang in Dunhuang medical prescriptions may be a modified version of the alternative-named Ban Xia Tang composed of Pinellia and Ginger from "Jin Gui Yao Lue." In the clinical treatment of cough and phlegm-dampness diseases, emphasis should be placed on the application of two classic formulas, Si Jun Zi Tang and Er Chen Tang, which are composed of core herbs. It is evident that the study of data mining on Ban Xia Tang in Dunhuang and ancient medical literature helps to trace back the historical origins of the prescription compatibility of Ban Xia Tang, aims to provide a profound understanding of the Ban Xia Tang recorded in the Dunhuang ancient medical prescriptions, and also to inherit the therapeutic ideas of Dunhuang medical prescriptions. This study indicates to future medical practitioners the scientific system of medication compatibility rules for the development of new drugs and clinical prescription compatibility using core herbs.

7. References

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