



# Study on Professor Diangui Li's Medication Experience in Treating Atrophic Gastritis Concomitant with *Helicobacter Pylori* Infection Based on Data Mining

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## Abstract

**Objective** Our objective was to explore the national traditional Chinese medicine by studying master Diangui Li's medication experience in treating atrophic gastritis (AG) concomitant with *Helicobacter pylori* (Hp) infection based on data mining, and to provide the reference for the clinical treatment of relevant diseases.

**Methods** The Chinese medicine prescriptions of the patients' first visits to the Famous Doctors' Consultation Room in Hebei Provincial Hospital of Chinese Medicine from May 2019 to December 2022 were collected and frequency analysis of the Chinese herbs, association rules analysis of the Chinese herbs, and cluster analysis were conducted using the Famous Doctor Inheritance Assistance Platform.

**Results** A total of 188 prescriptions were collected, with 136 kinds of Chinese herbs. The highest use frequency of Chinese herbs was 185 and the lowest was 1. There were 28 kinds of Chinese herbs with high use frequency. The top 10 herbs with the high use frequency include Baihuasheshecao (*Hedyotis Diffusae Herba*), Huanglian (*Coptidis Rhizoma*), Yinchen (*Artemisiae Scopariae Herba*), Jigucuo (*Abriherba*), Baishao (*Paeoniae Radix Alba*), Danggui (*Angelicae Sinensis Radix*), Banzhilian (*Scutellariae Barbatae Herba*), Baihe (*Lilii Bulbus*), Zhishi (*Aurantii Immaturus Fructus*), Chuanxiong (*Chuanxiong Rhizoma*). Chinese herbs with high frequency use are mostly heat-clearing herbs and qi-regulating herbs; the flavors of the herbs are mainly pungent, bitter, and sweet; the properties are mainly warm, cold, and neutral; the meridian tropism is mainly the spleen, liver, and stomach meridians. The core herbal medicines are Huanglian (*Coptidis Rhizoma*), Yinchen (*Artemisiae Scopariae Herba*), Baishao (*Paeoniae Radix Alba*), Danggui (*Angelicae Sinensis Radix*), etc.; the results of association rules: Jigucuo (*Abriherba*)-Kushen (*Sophorae Flavescens Radix*), Jiaogulan (*Gynostemmatis Pentaphylli Rhizoma seu Herba*)-Banlangen (*Isatidis Radix*), Huangqin (*Scutellariae Radix*)-Banlangen (*Isatidis Radix*), etc.; the results of cluster analysis showed that there were 10 clusters: (1) Yinchen (*Artemisiae Scopariae Herba*), Huanglian (*Coptidis Rhizoma*), Baihuasheshecao (*Hedyotis Diffusae Herba*), Banzhilian (*Scutellariae Barbatae Herba*), Jigucuo (*Abriherba*); (2) Baishao (*Paeoniae Radix Alba*), Danggui (*Angelicae Sinensis Radix*), Chuanxiong (*Chuanxiong Rhizoma*), Wuyao (*Linderae*

## Keywords

- ▶ atrophic gastritis
- ▶ *Helicobacter pylori* infection
- ▶ data mining
- ▶ medication
- ▶ Diangui Li

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Radix); (3) Yuanhu (Corydalis Rhizoma), Danshen (Salviae Miltiorrhizae Radix et Rhizoma), Baizhi (Angelicae Dahuricae Radix).

**Conclusions** For the treatment of AG concomitant with Hp infection, Professor Diangui Li mainly adopts the method of clearing heat and removing the toxin, regulating qi and resolving phlegm, combining disease differentiation with syndrome differentiation, performing reinforcing method, and reducing method simultaneously to regulate the mechanism of the human body.

## Introduction

*Helicobacter pylori* (Hp) is a spiral-shaped microaerophilic gram-negative bacterium that mainly resides in the mucus layer of the stomach. It can survive in the acidic environment of the stomach, causing gastric inflammation and accelerating the aging of gastric epithelial cells.<sup>1,2</sup> Some patients infected with Hp do not have any uncomfortable symptoms, and further development leads to changes in the gastric epithelial environment, inflammatory production, epithelial cell aging, and atrophy, mostly due to epigastric discomfort, stomach pain, abdominal distension, heartburn, acid regurgitation, hiccup, bad breath, halitosis, and irregular bowel movements. Hp infection is confirmed by Hp-invasive detection or noninvasive detection, and atrophic gastritis (AG) is confirmed by gastroscopy. At present, there is clear Hp elimination treatment at home, which uses triple herbs (two antibiotics + proton pump inhibitors) and quadruple herbs (two antibiotics + proton pump inhibitor + bismuth subcitrate). The reversal effect is not obvious in patients with AG. Professor Diangui Li, the great national traditional Chinese medicine (TCM) master of the third batch, created “turbidity theory” and made great contributions to the treatment of spleen and stomach diseases in TCM, breaking the precancerous lesions of the stomach. This study was based on the collection of cases of AG concomitant with Hp infection diagnosed and treated by professor Diangui Li. The retrospective study was conducted to explore professor Diangui Li's clinical experience in treating the relevant diseases.

## Data and Source

### Sources of Cases

The Chinese medicine prescriptions from the first visits of the patients diagnosed with (chronic) AG concomitant with Hp infection treated in the outpatient department of the Famous Doctor Diangui Li's Consultation Room in Hebei Provincial Hospital of Chinese Medicine from May 2019 to December 2022 were collected. A total of 188 effective prescriptions were collected from patients with definite examination, examination results, detailed records of symptoms and signs, medical history, etc.

### Inclusion Criteria

Patients with a gastroscopy report were clearly diagnosed as (chronic) AG, and Hp was confirmed positive by C<sub>14</sub>, C<sub>13</sub>, or

other Hp detection methods; clinical symptoms included acid regurgitation, heartburn, abdominal distension, stomachache, and halitosis<sup>3</sup>; Chinese medicine were orally administered for at least three consecutive courses; after treatment, Hp infection was significantly negative and AG was significantly improved; age and gender were not restricted; simultaneous administration of Western medicine was not ruled out.

### Exclusion Criteria

Exclusion criteria were patients with hepatitis B, patients with diseases of the respiratory system or urinary system, patients with cerebral infarction, patients whose self-perceived symptoms were relieved but not reviewed, patients allergic to Chinese herbs, and patients with incomplete case data.

### Data Management

The names and efficacy of the Chinese herbs were mainly referred in the 2020 edition of the *Pharmacopoeia of the People's Republic of China*<sup>4</sup> and *Chinese Materia Medica* and the fourth edition of *Science of Chinese Pharmacology*<sup>5</sup> for standardization. The database can be built on the website of the Famous Doctor Inheritance Assistance Platform, with the names and target symptoms of Chinese herbs, such as Danpi (Moutan Cortex) → Mudanpi (Moutan Cortex), Chuanjun (Rhei Radix et Rhizoma) → Dahuang (Rhei Radix et Rhizoma), Biandou (Lablab Semen Album) → Baibiandou (Lablab Semen Album), Doukou (Amomi Rotundus Fructus) → Zidoukou (Amomi Fructus Rotundus), etc. Houpo (Magnoliae Officinalis Cortex), Tubiechong (Eupolyphaga Steleophaga), Yanhusuo (Corydalis Rhizoma) were named after Chuanpo (Magnoliae Officinalis Cortex), Tuyuan (Eupolyphaga Steleophaga) and Yuanhu (Corydalis Rhizoma), respectively, to increase the use frequency of the same Chinese herb with different names.

### Data Statistics

The collected effective prescriptions were entered into Microsoft Excel for collation and induction and frequency analysis, a cohort on the Famous Doctor Inheritance Platform (<http://mingyi.bucm.edu.cn/>) was created, and the cleaned Chinese medicine prescriptions were entered into the cohort. One person entered the data, and the other checked the information to prevent data errors. Click the analysis results after data entry, and “herb rank” displayed the herb

**Table 1** The ranking of the importance of Chinese herbs

No.	Chinese herbs	Support degree	Effects	No.	Chinese herbs	Support degree	Effects
1	Huanglian (Coptidis Rhizoma)	0.98	Heat-clearing herb	15	Xiangfu (Cyperi Rhizoma)	0.56	Qi-regulating herb
2	Yinchen (Artemisiae Scopariae Herba)	0.95	Urination-promoting and dampness-draining herb	16	Sharen (Amomi Fructus)	0.56	Dampness-resolving herb
3	Baishao (Paeoniae Radix Alba)	0.88	Herb for tonification	17	Huoxiang (Agastachis Herba)	0.47	Dampness-resolving herb
4	Danggui (Angelicae Sinensis Radix)	0.88	Herb for tonification	18	Sugeng (Perillae Caulis)	0.41	Qi-regulating herb
5	Baihuasheshcao (Hedyotis Diffusae Herba)	0.86	Heat-clearing herb	19	Wugong (Scolopendra)	0.34	Liver-soothing and exogenous wind-calming herb
6	Chuangxiong (Chuanxiong Rhizoma)	0.86	Blood-activating and stasis-resolving herb	20	Quanxie (Scorpio)	0.32	Liver-soothing and exogenous wind-calming herb
7	Baihe (Lili Bulbus)	0.86	Herb for tonification	21	Banxia (Pinelliae Rhizoma)	0.33	Phlegm-resolving and cough-relieving herb
8	Wuyao (Linderae Radix)	0.86	Qi-regulating herb	22	Muxiang (Aucklandiae Radix)	0.32	Qi-regulating herb
9	Wheat bran-fried Baizhu (Atractylodis Macrocephalae Rhizoma)	0.85	Herb for tonification	23	Fried Laifuzi (Raphani Semen)	0.29	Digestion-improving herb
10	Baizhilian (Scutellariae Barbatae Herba)	0.83	Heat-clearing herb	24	Yuanhu (Corydalis Rhizoma)	0.29	Blood-activating and stasis-resolving herb
11	Jigucuo (Abrilerba)	0.76	Heat-clearing herb	25	Danshen (Salviae Miltiorrhizae Radix et Rhizoma)	0.25	Blood-activating and stasis-resolving herb
12	Kushen (Sophorae Flavescentis Radix)	0.76	Heat-clearing herb	26	Haipiaoxiao (Sepiae Endoconcha)	0.25	Astringent herb
13	Zhishi (Aurantii Fructus Immaturus)	0.68	Qi-regulating herb	27	Peilan (Eupatorii Herba)	0.20	Dampness-resolving herb
14	Chuanpo (Magnoliae Officinalis Cortex)	0.61	Dampness-resolving herb	28	Banbianlian (Lobeliae Chinese Herba)	0.22	Heat-clearing herb

frequency and the frequency of matched pair of Chinese herbs cooccurrence in the same prescription; “herb–herb concurrence/exclusivity” showed the synergistic and mutually exclusive analysis of the matched pair of Chinese herbs; the “herb cluster” showed the clustering of matched pair of Chinese herbs.

## Results

### The Ranking of the Importance of Chinese Herbs

A total of 188 cases from May 2019 to December 2022 were screened in line with the medical records, and 188 prescriptions of the first visits involving 136 kinds of Chinese herbs were collected. The total use frequency of the Chinese herbs was 4,108 times, of which 28 kinds were core herbs with main effects of clearing heat (six times, 21.4%), regulating qi (five times, 17.85%), tonifying (four times, 14.29%), resolving dampness (four times, 14.29%), activating blood and resolving stasis (three times, 10.71%), and soothing the liver and calming exogenous wind (twice, 7.14%). The highest use frequency was 185 times and the lowest was 1. The ranking of the importance of Chinese herbs is specified in ►Table 1. The effect frequency of the core Chinese herbs is shown in ►Fig. 1. The correlation of the Chinese herbs is shown in ►Fig. 2. For the five flavors, the 28 core Chinese herbs included pungent herbs (19 times, 43%), bitter herbs (14 times, 32%), sweet herbs (7 times, 16%), sour herbs (twice, 5%), bland herbs (once, 2%), and salty herbs (once, 2%), as specified in ►Fig. 3. For the four properties, the 28 core Chinese herbs included warm herbs (13 times, 42%), cold herbs (8 times, 26%), neutral herbs (8 times, 26%), and cool herbs (twice, 6%), as specified in ►Fig. 4. For the meridian tropism, the 28 core Chinese herbs included spleen meridian (18 times, 22%), liver meridian (15 times, 18%), stomach meridian (14 times, 17%), lung meridian (10 times, 12%), and heart meridian (7 times, 8%), as specified in ►Fig. 5.

### Analysis of Chinese Herb-Chinese Herb Synergy and Mutual Exclusion

In the same prescription, the correlation between Chinese herbs was divided into nine grades. Red represented mutual exclusion of Chinese herbs, and blue represented the correlation between Chinese herbs, as specified in ►Fig. 6. Highly

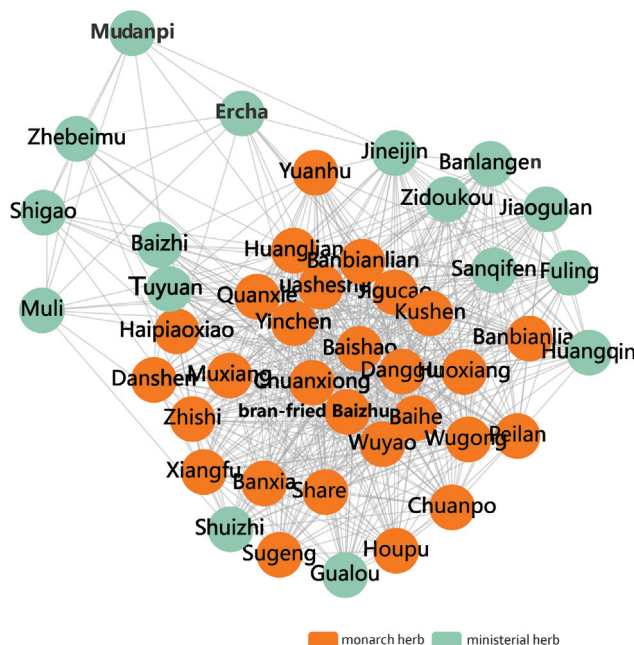


Fig. 2 Correlation of the Chinese herbs.

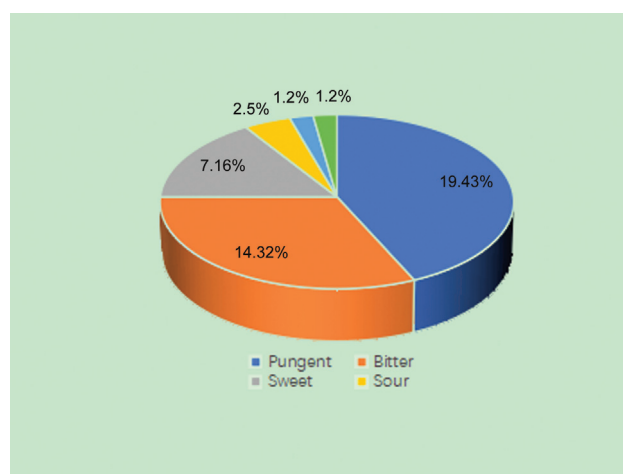


Fig. 3 Flavor analysis of the core Chinese herbs.

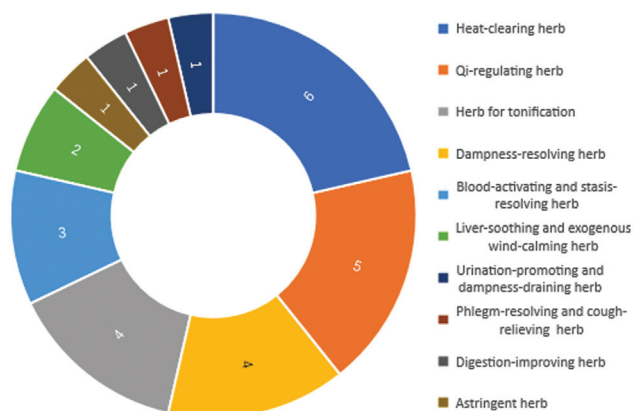


Fig. 1 Effect frequency of the core Chinese herbs.

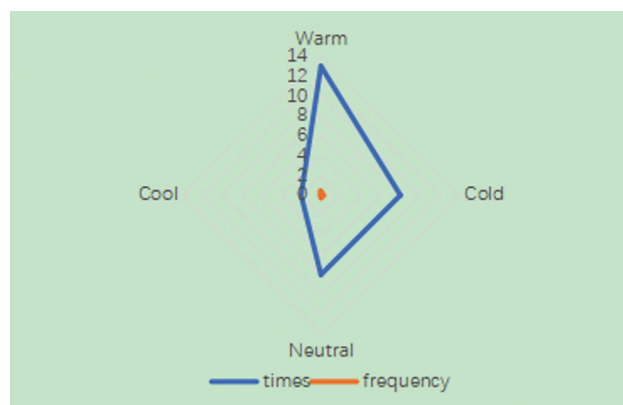
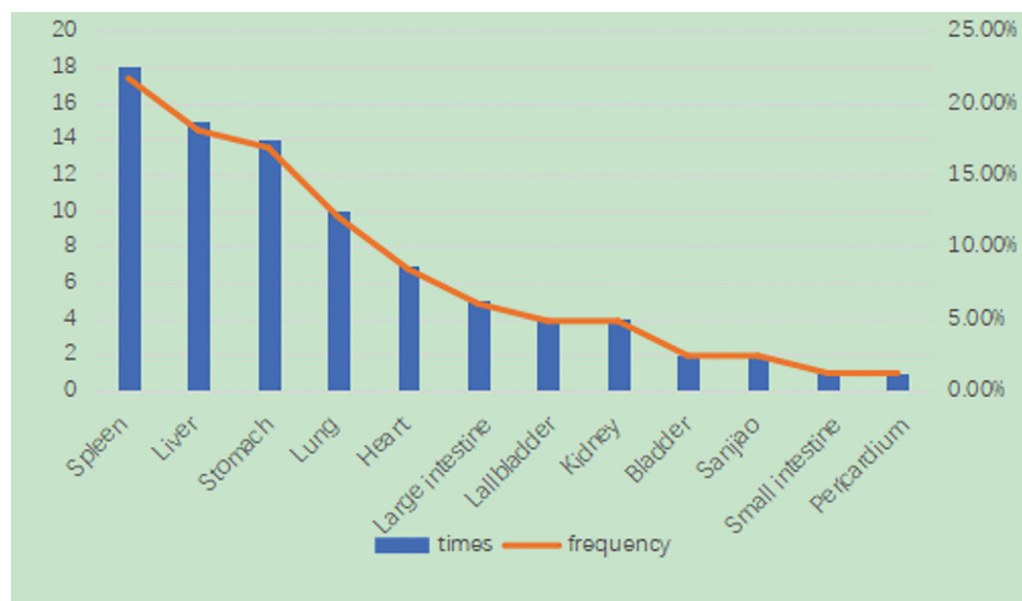


Fig. 4 Property analysis of the core Chinese drugs.



**Fig. 5** Meridian tropism frequency of the core Chinese herbs.

related Chinese herbs are as follows: Jigucuo (Abriherba)-Kushen (Sophorae Flavescentis Radix), Jiaogulan (Gynostematis Pentaphylli Rhizoma seu Herba)-Banlangen (Isatidis Radix), Huangqin (Scutellariae Radix)-Banlangen (Isatidis Radix), Huangqin (Scutellariae Radix)-Jiaogulan (Gynostematis Pentaphylli Rhizoma seu Herba), Baihe (Lilli Bulbus)-Wuyao (Linderae Radix), Baishao (Paeoniae Radix Alba)-Danggui (Angelicae Sinensis Radix), Honghua (Carthami Flos)-Sanleng (Sparganii Rhizoma), Xuanfuhua (Inulae Flos)-Daizheshi (Haematitum), Zhiqiao (Aurantii Fructus)-Dangshen (Codonopsis Radix), Yuanzhi (Polygalae Radix)-Dangshen (Codonopsis Radix), fried Maiya (Hordei Fructus Germinatus)-Shanzha (Crataegi Fructus), Yuanzhi (Polygalae Radix)-Zhiqiao (Aurantii Fructus).

### Chinese Herb Cluster Analysis

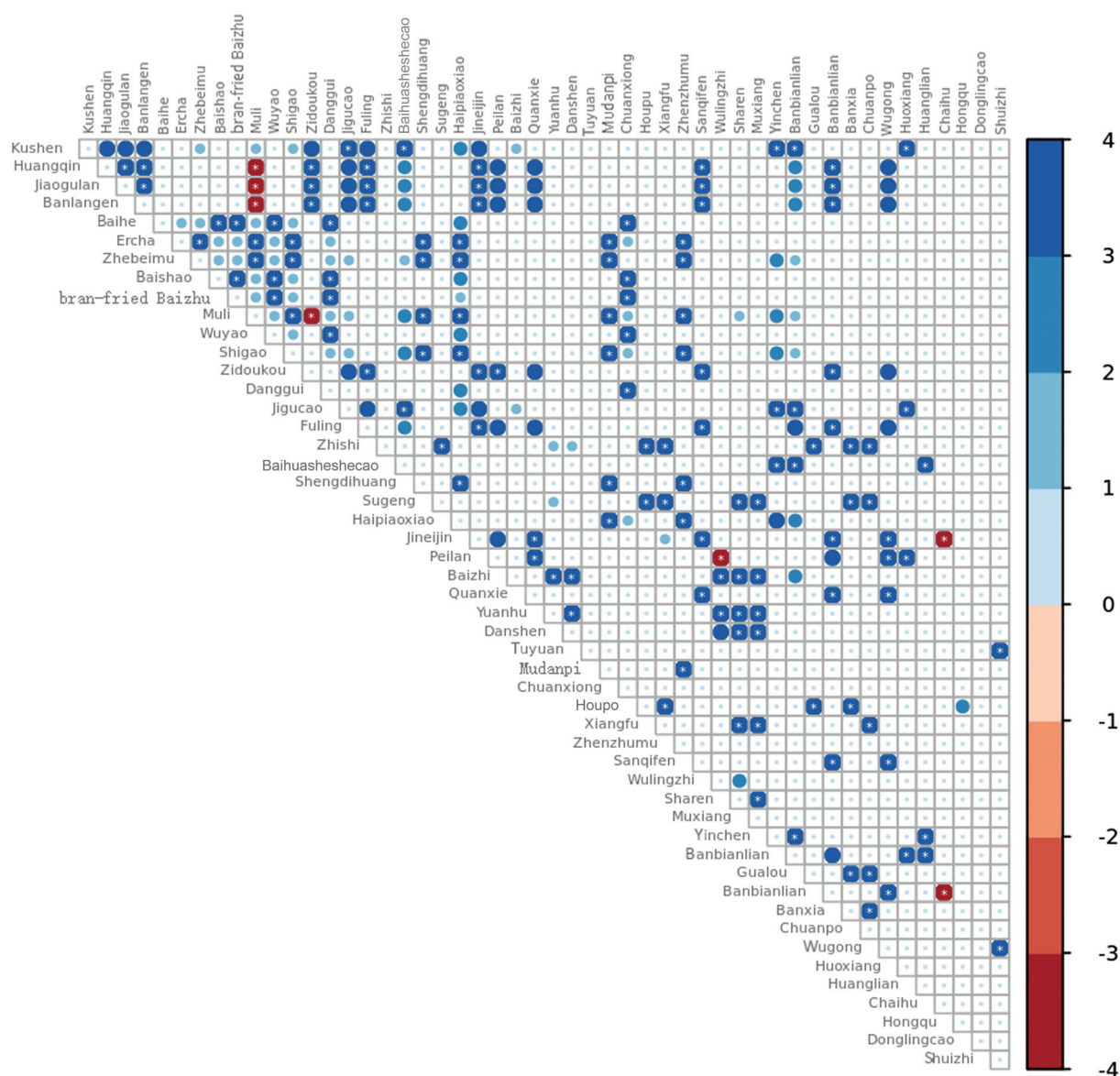
Cluster analysis of the Chinese herbs in the prescriptions was performed, and a total of 10 clusters of new Chinese medicine prescriptions were obtained, as specified in ▶Fig. 7. The new prescriptions of 10 clusters of Chinese herbs were displayed in a bar chart, as specified in ▶Fig. 8. The frequency of each Chinese herb in the new prescriptions was obtained from ▶Figs. 7 and 8, as shown in ▶Fig. 9. A total of 10 new prescriptions were obtained. In combination with professor Dianguai Li's clinical experience, the Chinese herbs in the new prescriptions were ranked from high to low according to the frequency of Chinese herbs in the new prescriptions. There were four prescriptions with a frequency of  $\geq 0.4$ : (1) herbs for clearing heat and removing toxin: Huanglian (Coptidis Rhizoma), Yinchen (Artemisiae Scopariae Herba), Baihuasheshicao (Hedyotis Diffusae Herba), Banzhilian (Scutellariae Barbatae Herba), and Jigucuo (Abriherba); (2) herbs for activating blood and qi movement: Baishao (Paeoniae Radix Alba), Danggui (Angelicae Sinensis Radix), Chuanxiong (Chuanxiong Rhizoma), Baihe (Lilli Bulbus), and Wuyao (Linderae Radix); (3) herbs for resolving dampness and

activating qi: Chuanpo (Magnoliae Officinalis Cortex), Sharen (Amomi Fructus), Huoxiang (Agastachis Herba), and Sugeng (Perillae Caulis); (4) herbs for resolving phlegm and activating qi: Zhishi (Aurantii Fructus Immaturus), and Xiangfu (Cyperi Rhizoma).

### Discussion

Hp infection is mainly caused by mouth-mouth or fecal-mouth transmission. It can be discovered through physical examination or medical screening when people feel epigastric discomfort. Modern clinical trials have proved that the simultaneous expression of the genes of the bacterial strains *cagA*, *vacA*, and *iceA* in Hp infection has a certain relationship with AG, which can lead to further aggravation of AG.<sup>6</sup> In ancient TCM books, gastric diseases are mostly treated based on syndrome differentiation, and the diseases are mainly named after the symptoms. Hp infection is often concomitant with abdominal distension, heartburn, epigastric pain, bad breath, loss of appetite, hiccups, and irregular bowel movements, which is equivalent to the categories of "stomach stuffiness," "stomachache," and "acid regurgitation". Hp belongs to the "toxin" in TCM. The TCM treatments for toxins include clearing heat and removing the toxin, cooling blood and removing the toxin, draining dampness and removing the toxin, and purging fire and removing toxin. Different from Western medicine, the constitution is adjusted on the basis of syndrome differentiation, and removing the toxin is conducted in combination with taking care of the overall situation of the patient. For the treatment of Hp infection, triple herbs (two antibiotics + PPI) and quadruple herbs (two antibiotics + PPI + bismuth subcitrate) are recommended internationally. During the clinical treatment, some patients often suffer from epigastric discomfort, stomachache, and irregular bowel movements after taking triple or quadruple herbs. Professor Dianguai Li is particularly good at treating





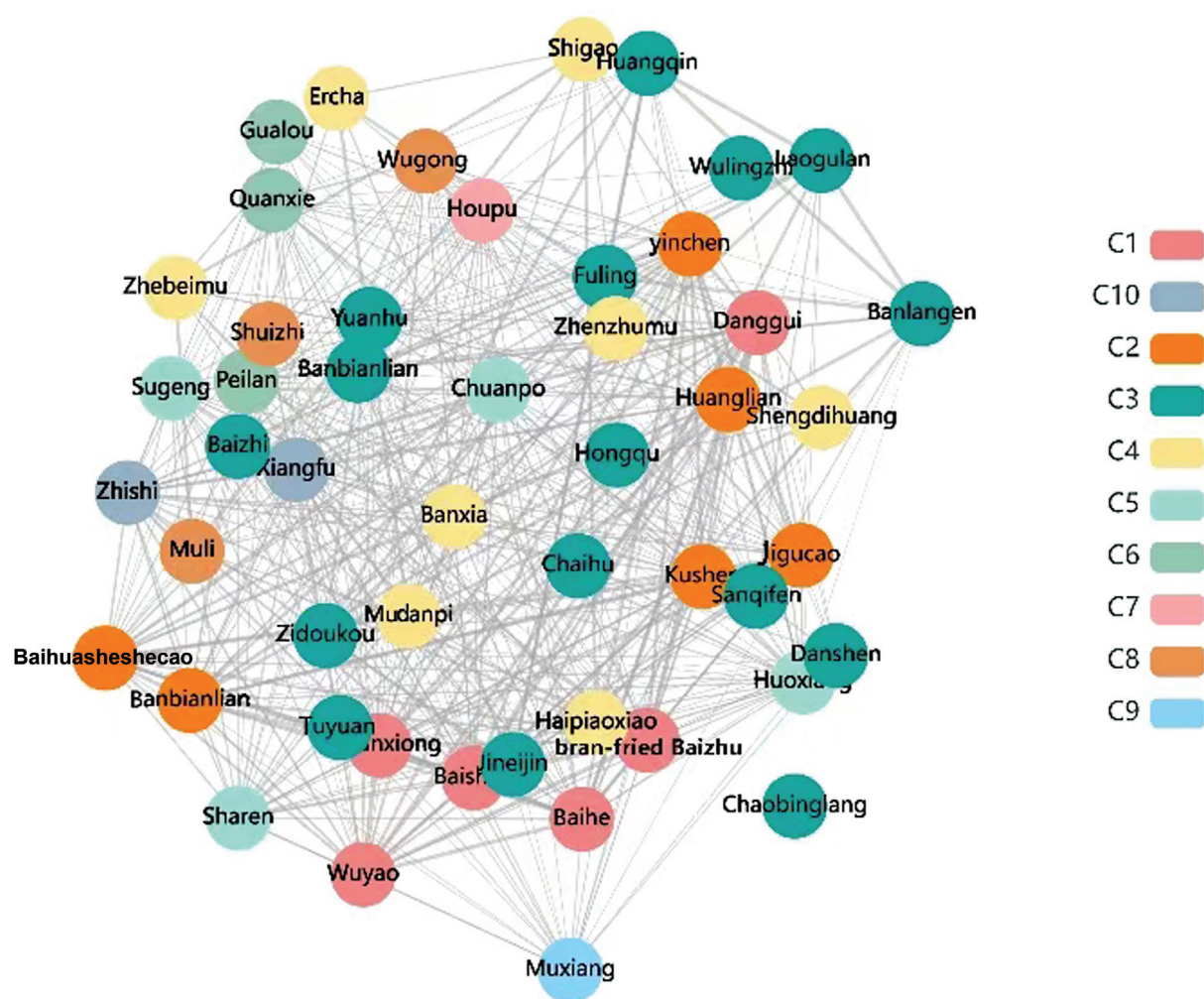
**Fig. 6** Analysis of Chinese herb–Chinese herb synergy and mutual exclusion.

spleen and stomach diseases. He has unique insights into the treatment of Hp and intestinal metaplasia as the precancerous lesions of the stomach. He applies the theory of “turbid toxin” to explain the “turbid toxin of the heaven,” “turbid toxin of the earth,” and “turbid toxin of the man.” Through a large number of clinical observations, it is proposed that AG is treated according to the “syndrome of turbid toxin accumulating in the stomach,” which takes the removal of turbidity and toxin as the fundamental method, combined with the methods of activating blood, tonification, soothing liver, and activating qi.<sup>7</sup>

### Analysis of High-Frequency Chinese Herbs

According to statistics, there are a total of 28 core Chinese herbs with high frequency. According to the effects of Chinese herbs, they can be classified into heat-clearing herbs, qi-regulating herbs, tonifying herbs, dampness-resolving herbs, blood-activating and stasis-resolving herbs, and liv-

er-soothing and exogenous wind-calming herbs. Huanglian (Coptidis Rhizoma) in the *Orthodox Interpretation of the Materia Medica (Ben Cao Zheng Yi)* was recorded as “Huanglian (Coptidis Rhizoma) is greatly bitter and cold, and the bitter flavor can dry dampness and cold property can reduce heat, which can purge and lower all surplus dampness fire... all belong to the effect of drying dampness and clearing heat.” According to Dongyuan Li: “Improper diet damages the stomach...the earth is generated from fire, and it also purges the excessive fire in the spleen and stomach.”<sup>8</sup> Professor Diangu Li is good at using Huanglian (Coptidis Rhizoma) in the treatment of related diseases of AG concomitant with Hp infection due to internal accumulation of turbid toxin, with commonly seen dampness–heat symptoms and signs of stomach distension, acid regurgitation, heartburn, stomachache, sticky and greasy sensation in mouth, bad breath, sticky stools, and red tongue with yellow and greasy tongue coating. Huanglian (Coptidis Rhizoma) is characterized by



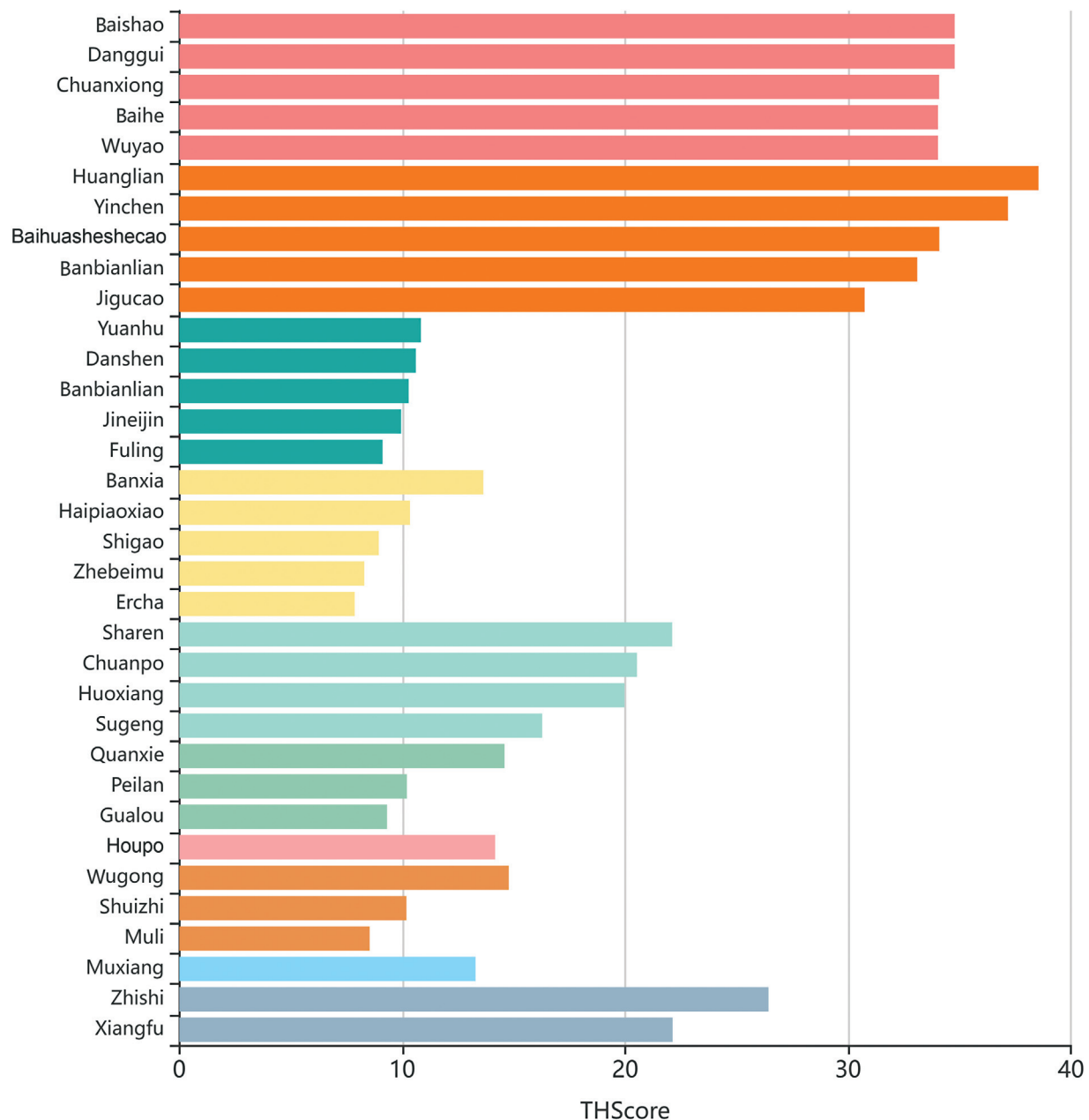
**Fig. 7** Clusters visualization of Chinese herbs.

direct repulsion with bitter cold and thus can directly clear dampness heat. Modern research shows that the chemical components in Huanglian (*Coptidis Rhizoma*) have inhibitory effects on *Hp* infection.<sup>9</sup> In combination with the results of modern medical technology examination and TCM syndrome differentiation and treatment, professor Diangui Li believes that bacteria can adapt to damp-heat conditions, and Huanglian (*Coptidis Rhizoma*) can be used to adjust the human body's dampness heat. On the basis of environmental treatment, tonification herbs are added since AG is often due to spleen and stomach deficiency caused by improper diet. Danggui (*Angelicae Sinensis Radix*), Baishao (*Paeoniae Radix Alba*), and Baihe (*Lilli Bulbus*) exert therapeutic effects on the yin aspect by nourishing yin and blood to strengthen healthy qi. Diangui Li performs syndrome-symptom-disease differentiation and takes into account both deficiency and excess. Prolonged internal accumulation of turbid toxin are embedded within the body, more heat is transformed into heat, and heat-clearing herbs are mainly used. The spleen governing rise of the clear while stomach governing descent of the turbid. The smooth qi mechanism of the middle energizer will promote healthy spleen and stomach to perform the

functions of transportation and transformation, so qi-regulating herbs are added; the spleen and stomach as acquired foundation directly receive water and food, so they may be affected by improper dietary habits and become deficient and impaired. AG is related to the blood collaterals of the spleen and stomach, so Danggui (*Angelicae Sinensis Radix*) and Baishao (*Paeoniae Radix Alba*) are used to nourish blood and yin, activate blood flow and astrinse yin; the spleen prefers dryness while dislikes dampness, so the method of resolving dampness is often applied to strengthen the spleen with aromatic dampness-resolving herbs such as Houpo (*Magnoliae Officinalis Cortex*), Sharen (*Amomi Fructus*), Huoxiang (*Agastachis Herba*), and Peilan (*Eupatorii Herba*); since the stomach prefers moisture while dislikes dryness, Baishao (*Paeoniae Radix Alba*) and Baihe (*Lilli Bulbus*) are combined.

#### Correlation Analysis of the Core Chinese Herbs

According to the results of the matched pair of Chinese herbs synergistic and mutually exclusive analysis, the commonly used herb pairs in the treatment of *Hp* with turbid toxin pattern concomitant with AG-related diseases include

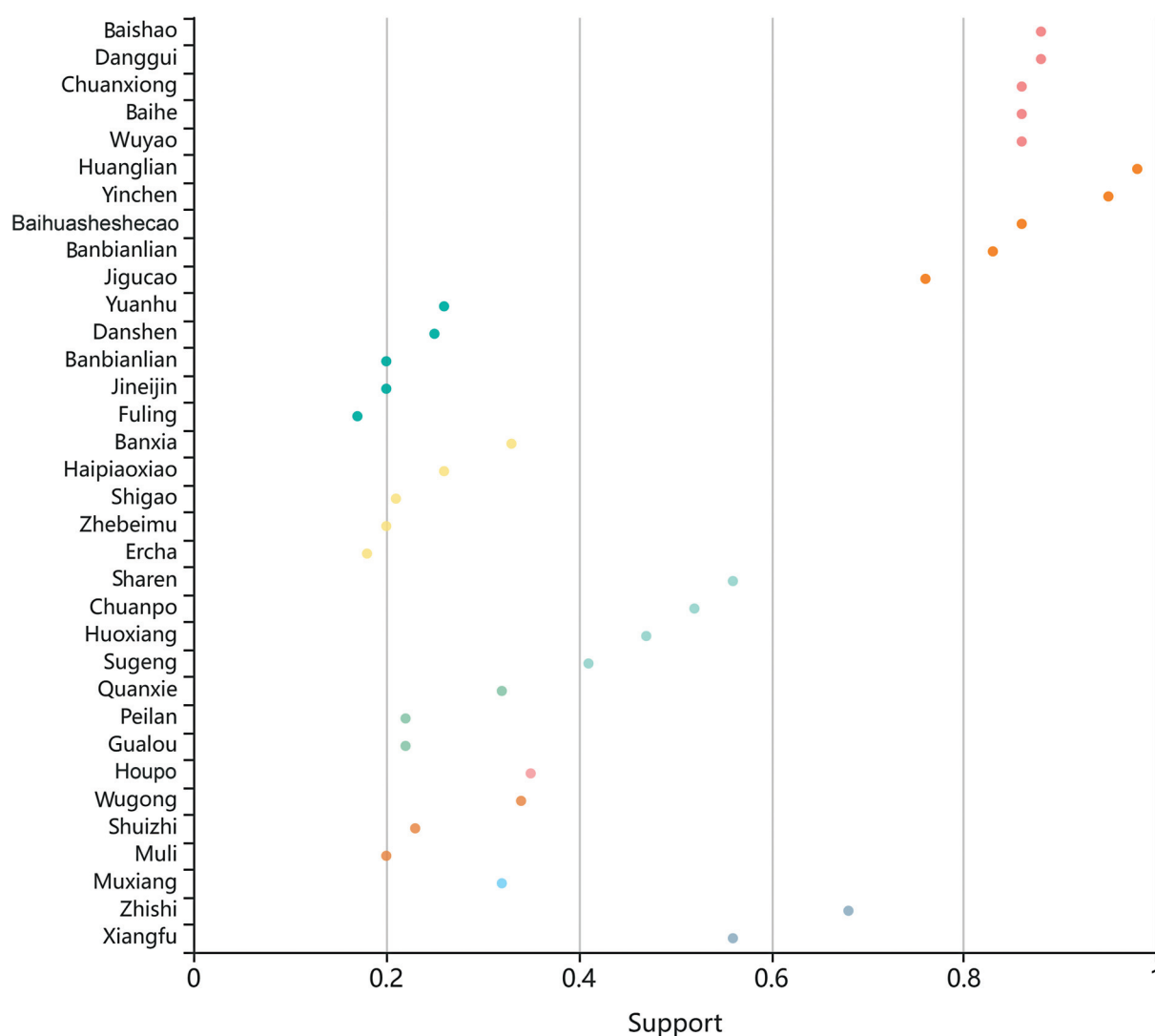


**Fig. 8** Bar chart of the Chinese herbs.

Jigucao (Abriherba)-Kushen (*Sophorae Flavescentis Radix*): Jigucao (Abriherba) is sweet and slightly bitter in flavor and cool in property and pertains to the liver and stomach meridians with effects of draining dampness and removing jaundice, clearing heat and removing toxin, soothing liver, and checking pain. According to *Herbal Materia Medica of the Lingnan Region (Ling Nan Cao Yao Zhi)*, “it clears depressed heat, soothes liver, harmonizes spleen and reunifies fractured bones.” The middle energizer fails to transport and transform due to internal accumulation of turbid toxin and dampness heat. Jigucao (Abriherba) has the effects of resolving dampness heat and strengthening the spleen and stomach, and the combination with Kushen (*Sophorae Flavescentis Radix*) can enhance the effects of clearing heat. In *Convenient Reader on Materia Medica (Ben Cao Bian Du)*, it is

recorded that “it can enter the blood aspect of the liver and stomach and exert four effects of clearing heat, removing toxin, warding off pestilence and killing worms. The leaves dominate dispersion while the roots dominate descent.” According to Dianguai Li, “Hp infection with internal accumulation of turbid toxin pattern concomitant with AG is mostly located in the blood aspect of the stomach”. Banlangen (*Isatidis Radix*) enters the heart and stomach meridians, performs direct repulsion with bitter cold, and lowers stomach qi which is in line with the physiological function of the stomach to descend. Modern research indicates that Banlangen (*Isatidis Radix*) can inhibit the growth of Hp.<sup>10</sup> In *Chinese Herbal Medicine (Zhong Hua Ben Cao)*, it is recorded that “Jiaogulan (*Gynostematis Pentaphylli Rhizoma seu Herba*) is bitter and slightly sweet in flavor and cool in property,





**Fig. 9** Frequency of Chinese herbs in the new prescriptions.

pertains to the lung, spleen and kidney meridians, and has the effects of clearing heat, tonification, removing toxin." The combination of Banlangen (*Isatidis Radix*) and Jiaogulan (*Gynostematis Pentaphylli Rhizoma seu Herba*) provides both reinforcing and reducing effects. Baihe (*Lilli Bulbus*) is sweet in flavor and cold in property and enters the heart and lung meridians; Wuyao (*Linderae Radix*) is pungent in flavor and warm in property and enters the lung, spleen, kidney and gallbladder meridians. It is recorded in *Ingenious Uses of Post-classical Formulas (Shi Fang Miao Yong)* that "qi-related pain, deep and uneven pulse are caused by depression of seven emotions...Baihe Decoction." "Fire-related pain, rapid and forceful pulse, thirst and red complexion, feverish body and constipation...Baihe Decoction."<sup>11</sup> The two herbs as well as disease differentiation and syndrome differentiation are combined. Diangu Li is cautious in using herbs and flexibly combines cold herbs with warm herbs to mutually supplement. Danggui (*Angelicae Sinensis Radix*) is mostly classic blood-tonifying herb pair. Danggui (*Angelicae Sinensis Radix*) is

sweet and pungent in flavor, warm in property, and enters the liver, heart, and spleen meridians; Baishao (*Paeoniae Radix Alba*) is bitter and sour in flavor, slightly cold in property, and enters the liver and spleen meridians. The combination of the two herbs has the effects of nourishing blood and liver and relieving pain.

### Cluster Analysis of the Chinese Herbs

After statistical analysis, four new prescriptions were finally obtained, namely, heat-clearing and toxin-removing formula, blood and qi-activating formula, dampness-resolving and qi-activating formula, and phlegm-resolving and qi-activating formula.

- (1) Heat-clearing and toxin-removing formula: composition: Huanglian (*Coptidis Rhizoma*), Yinchen (*Artemisiae Scopariae Herba*), Baihuashe Shecao (*Hedyotis Diffusae Herba*), Banzhilian (*Scutellariae Barbatae Herba*), and Jigucao (*Abriherba*). Based on the internal accumulation of turbid toxin and the main syndrome

of dampness heat, Diangui Li often uses these Chinese herbs. Huanglian (*Coptidis Rhizoma*) bitter in flavor and cold in nature goes straight to the middle energizer, and Yinchen (*Artemisiae Scopariae Herba*) clears dampness heat. Baihuasheshecao (*Hedyotis Diffusae Herba*) and Banzhilian (*Scutellariae Barbatae Herba*) could not only clear away heat and remove toxins, but also prevent cancer transmission. Jigucuo (*Abriherba*) can strengthen the effect of clearing away heat and removing toxins. All these herbs are heavy ones for turbid toxins and dampness heat. Diangui Li often stops the medication of the herbs with drastic effects when the disease becomes moderate since the spleen and stomach have been damaged and no more burdens should be imposed.

- (2) Blood and qi-activating formula: composition: Baishao (*Paeoniae Radix Alba*), Danggui (*Angelicae Sinensis Radix*), Chuanxiong (*Chuanxiong Rhizoma*), Baihe (*Lilli Bulbus*), and Wuyao (*Linderae Radix*). This prescription evolves from Siwu Decoction composed of Shudihuang (*Rehmanniae Radix Praeparata*), Danggui (*Angelicae Sinensis Radix*), Baishao (*Paeoniae Radix Alba*), and Chuanxiong (*Chuanxiong Rhizoma*) and Baihe Decoction composed of Baihe (*Lilli Bulbus*) and Wuyao (*Linderae Radix*). Hp infection concomitant with AG enters the blood collaterals of the stomach. The spleen and stomach are weak and thus phlegm-dampness arises. Shudihuang (*Rehmanniae Radix Praeparata*) is greasy and should not be used because the tongue texture of the patient is mostly dark red with yellow and greasy tongue coating.<sup>12</sup> Baishao (*Paeoniae Radix Alba*), Danggui (*Angelicae Sinensis Radix*), and Chuanxiong (*Chuanxiong Rhizoma*) can not only enter blood aspect to promote blood circulation and nourish blood but also promote qi movement and relieve pain. Baihe (*Lilli Bulbus*) and Wuyao (*Linderae Radix*) are added to treat stomachache caused by the internal accumulation of turbid toxin with qi stagnation and blood stasis.
- (3) Dampness-resolving and qi-activating formula: composition: Chuanpo (*Magnoliae Officinalis Cortex*), Sharen (*Amomi Fructus*), Huoxiang (*Agastachis Herba*), Sugeng (*Perillae Caulis*); the combination of the four herbs has the effects of resolving dampness with aromatic herbs, activating qi movement and harmonizing the middle energizer, of which the property is warm and complies with the theory of “diseases due to phlegm and fluid retention should be harmonized with warm herbs.”<sup>13</sup> According to Diangui Li, “When removing the turbid toxin, we still need to consider the weakness of the spleen and stomach. Taking care of the acquired foundation is the main purpose. To strengthen the spleen, we need to remove dampness and revive the spleen, so aromatic herbs are often used. Phlegm and dampness belong to yin, and qi belongs to yang. When qi circulates, phlegm and dampness are easily eliminated.” Therefore, there are many qi-activating herbs for treating phlegm-damp accumulation.

- (4) Phlegm-resolving and qi-activating formula: composition: Zhishi (*Aurantii Fructus Immaturus*) and Xiangfu (*Cyperii Rhizoma*). Zhishi (*Aurantii Fructus Immaturus*) is bitter, pungent, and sour in flavor and slightly cold in property, and pertains to the spleen and stomach meridians. In *Origins of Medicine (Yi Xue Qi Yuan)*, Zhishi (*Aurantii Fructus Immaturus*) “dominates heart fullness, resolves phlegm in the chest, improves digestion, disperses sepsis and breaks hard masses.” Zhishi (*Aurantii Fructus Immaturus*) can remove obstinate phlegm and dirt, break qi, and eliminate phlegm. Modern research shows that many chemical components in it can regulate gastrointestinal qi movement and improve gastrointestinal function.<sup>14</sup> For irregular bowel movements, constipation, and abdominal distension, it is often used in combination with Baizhu (*Atractylodis Macrocephalae Rhizoma*), which derives from the meaning of “Zhizhu decoction.” Xiangfu (*Cyperii Rhizoma*) is pungent, slightly bitter, and slightly sweet in flavor and neutral in property, it pertains to the liver, spleen, and triple energizer meridians and can be used in combination with the Zhishi (*Aurantii Fructus Immaturus*) to unblock the triple energizer and give the phlegm pathogen a way out. For gastric discomfort caused by liver depression subjugating the spleen, it can soothe the liver and regulate qi, promote gastrointestinal peristalsis, and have a certain effect on the prevention of inflammatory factors.<sup>15</sup>

## Conclusions

For the treatment of Hp infection concomitant with AG-related diseases, the great national TCM master Diangui Li performs syndrome differentiation on the basis of a comprehensive constitution, takes “internal accumulation of turbid toxin” as the guideline, combines syndromes and symptoms, strictly selects herbs, uses heat-clearing and toxin-removing herbs for eliminating pathogens and stops medication of the herbs with drastic effects when the disease becomes moderate, regulates and nourishes the spleen and stomach as the fundamental method, promotes blood circulation and nourishing blood, reduces phlegm, and promotes qi movement simultaneously. In this study, the measurement and pharmacological study of the Chinese herbs have not been carried out, and further research and experiments are needed to provide more evidence.

## CRedit Authorship Contribution Statement

X.F. was responsible for conceptualization, project administration, and supervision. D.L. was responsible for resources and funding acquisition. Y.T. was responsible for data curation and formal analysis. J.W. was responsible for the investigation and methodology. Z.S. was responsible for the investigation and project administration. F.Z. was responsible for validation and visualization. H.Z. was responsible for the formal analysis, investigation, visualization, and writing-original draft.

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### Conflict of Interest

The authors declare no conflict of interest.

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