

Article

Network pharmacology of medicinal attributes and functions of Chinese herbal medicines: (II) Relational networks and pharmacological mechanisms of medicinal attributes and functions of Chinese herbal medicines

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Abstract

In present study, the database, CHM-DATA, with 1127 Chinese herbal medicines mainly having recorded chemical composition, involving 7 taste attributes, 5 medicinal properties, 1 toxicity attribute, 22 chemical composition categories, 12 meridians and collaterals (Gui Jing), and 78 medicinal functions (Gong Xiao), was used to calculate point correlations between these 125 attributes. Totally four relational networks, i.e., the networks for medicinal attributes and functions, for chemical composition and meridians and collaterals, for meridians and collaterals and medicinal functions, and for meridians and collaterals were constructed based on the significant point correlations. Network analysis indicated that the former three ones are scale-free complex networks and the last one tends to be a random network. Node degrees of the four networks follow power-law distribution. Detailed between-attribute relationships and medicinal mechanisms were revealed. For example, concerning chemical composition categories, alkaloids and amines have positive correlation / correspondence. More alkaloids correspond to more amines. Alkaloids negatively correlate with volatile oils / ordinary oils, carbohydrates / starch, ketones / flavonoids, and olefins. Alkaloids mainly function in decrease internal heat, dry dampness, etc. Organic acids and alkaloids have negative correlation. More organic acids mean the less alkaloids. Organic acids mainly act on large intestine meridians and collaterals, and function in moisten dryness. As for meridians and collaterals, kidney meridians and collaterals negatively correlate with lung meridians and collaterals, stomach meridians and collaterals, and large intestine meridians and collaterals. Kidney meridians and collaterals positively function in consolidate or warm kidney, invigorate male impotence (Yang) or strengthen male essence, strengthen bones and muscles, stop diarrheal, regulate menstruation or promote blood flow, relieve rheumatism or lubricate the joints, and negatively function in clear away heat, and detoxification.

Keywords Chinese herbal medicines; medicinal attributes; medicinal functions; networks; network analysis; pharmacological mechanisms.

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1 Introduction

Successful stories of drug design have been significantly decreased over the past 20 years. Due to the lack of medicinal functions and unexpected toxicity of drugs, the failure in clinical trials accounts for more than half of drug failure cases in the world. It has been attributed to the unreasonable guiding ideology of drug design that bases on the single drug-single target-single disease view in traditional western medicine (Hopkins, 2007, 2008; Budovsky and Fraifeld, 2012; Zhang, 2016b, c). Complex diseases do not usually arise from mutation or dysfunction of a single molecule, but are usually resulted from dysfunction of whole biological network (Zhang, 2016a, b; Zhang, 2017). In a network, if a single molecule changes insignificantly, they will collectively trigger a substantial change in the whole signal path. Therefore the network-based disease analysis and treatment becomes a trend. Traditional Chinese Medicine focuses on the whole regulation of biological network, so it provides a new approach to disease prevention and drug research and development. Nevertheless, Traditional Chinese Medicine, especially its intrinsic mechanism and scientific principles, have not yet reasonably explained and it lacks of theoretical system of network pharmacology. Consequently it is necessary to establish a new and reasonable interpretation system for Traditional Chinese Medicine. Through such basic research we can correct the deviation of medicinal cognition and enrich the theory of medicinal attributes (Wang, 2012). In the past years, some researchers have studied the four Qi and functions of Traditional Chinese Medicine, the natural attributes of medicines, etc. Zhang (2017) collected a total of 1127 Chinese herbal medicines mainly with recorded chemical composition, and calculated the basic statistics of medicinal attributes and functions, e.g., totals, frequencies or probabilities, percentages, etc., on the basis of total population of medicines and families. So far we still lack of extensive and in-depth research and coverage in this area. As the second step of our series studies, the present study aims to determine between-attribute correlations, construct relational networks and analyze pharmacological mechanisms of medicinal attributes and functions of Chinese herbal medicines, in order to provide a basis for further studies.

2 Material and Methods

2.1 Data source

In this study, a collection of 1127 Chinese herbal medicines mainly with recorded chemical composition was used (Zhang, 2017), of which 210 families and approximately 2000 species of medicinal plants and fungi were involved. In total of 125 attributes, including 7 taste attributes, 5 medicinal properties, 1 toxicity attribute, 22 chemical composition categories, 12 meridians and collaterals (Gui Jing), and 78 medicinal functions (Gong Xiao), were used. All of the Chinese herbal medicines had been numerically coded according to medicine name, species, family, medicinal attributes and medicinal functions (Zhang, 2017). The resultant coding database, CHM-DATA Version 1.0, an interactive database that includes eight tables, was used in present study. The data with missing attribute values are ignored in the study.

In the attribute statement, “/” means “or” or “and”.

2.2 Methods

2.2.1 Point correlation

Suppose there are n Chinese herbal medicines. The point correlation between attributes x and y is (Zhang, 2007; Zhang, 2012b, 2014, 2015b; Zhang et al., 2014; Zhang and Fang, 1982)

$$r=(ad-bc)/((a+b)(c+d)(a+c)(b+d))^{1/2}$$

where $-1 \leq r \leq 1$, both attribute x and attribute y take values 0 or 1. a is number of both attribute x and attribute y take value 0, b is number of attribute x takes 0 and attribute y takes 1, c is number of attribute x takes 1 and

attribute y takes 0, and d is number of both attribute x take value 1. $n=a+b+c+d$. Greater and positive r means a positive point correlation between attributes x and y ; Greater and negative r means a negative point correlation between attributes x and y .

Calculate

$$\chi^2 = n(ad-bc)^2 / [(a+b)(c+d)(a+c)(b+d)]$$

and if $\chi^2 > \chi_{\alpha}^2(1)$, the point correlation between attributes x and y is statistically significant at the level α .

The following is the Matlab function for point correlation and statistic test, pointCorrTest.m

```
% Zhang WJ. 2017. Network pharmacology of medicinal attributes and functions of Chinese herbal medicines:
% (II) Relational networks and pharmacological mechanisms of medicinal attributes and functions of Chinese herbal
% medicines. Network Pharmacology, 2(2): 38-66
function [pointcorr,sigpairs]= pointCorrTest(d,sig)
%Matrix d - rows: medicines; columns: attributes; sig=0.01, 0.001, 0.005, etc.
%pointcorr: matrix of between-attribute point correlations; sigpairs: attribute pairs at significant statistic
%level and corresponding point correlations.
m=size(d,2); n=size(d,1);
for i=1:m-1
for j=i:m
x=d(:,i); y=d(:,j);
aa=sum((x==0) & (y==0));
bb=sum((x==0) & (y~=0));
cc=sum((x~=0) & (y==0));
dd=sum((x~=0) & (y~=0));
pointcorr(i,j)=(aa*dd-bb*cc)/sqrt((aa+bb)*(cc+dd)*(aa+cc)*(bb+dd));
chi2(i,j)=n*(aa*dd-bb*cc)^2/((aa+bb)*(cc+dd)*(aa+cc)*(bb+dd));
pointcorr(j,i)=pointcorr(i,j);
chi2(j,i)=chi2(i,j);
end; end
chi2test=chi2>chi2inv(1-sig,1);
%chi2=10.8 for alpha=0.001; chi2=6.635 for alpha=0.01; chi2=7.87 for alpha=0.005
sigmat=chi2test.*pointcorr-eye(m);
[pairx,pairy,corrvalues]=find(sigmat);
temp1=pairx; temp2=pairy;
pairxs=pairx(temp1<temp2);
pairys=pairy(temp1<temp2);
corrvalueess=corrvalues(temp1<temp2);
sigpairs=[pairxs pairys corrvalueess]
```

2.2.2 Network analysis

In present study, Floyd algorithm is used to find (Floyd, 1962; Zhang, 2012b, 2016a) attribute chains. Use the methods for network type to determine network types (Zhang, 2012b; Zhang and Zhan, 2011), and network connectedness method to calculate connected components (Zhang, 2012b, 2016b).

3 Results and Analysis

3.1 Point correlation and relational networks

3.1.1 Relational network for medicinal attributes and functions

According to calculation and test, we obtained the pairwise attributes and corresponding point correlations with statistic significance ($\alpha=0.005$), as indicated in Table 1. The relational network for medicinal attributes and functions was constructed on the basis of the pairwise attributes with statistic significance ($\alpha=0.005$) (Zhang, 2011, 2012a-c), as illustrated in Fig. 1. In the network, there are 587 links.

In a sense, the network in Fig. 1 and pairwise attributes in Table 1 describe the pharmacological mechanisms of Chinese herbal medicines.

To fully cover these mechanisms, we listed the pairwise attributes and corresponding point correlations with statistic significance $\alpha=0.01$, as indicated in Appendix 1 (only the contents lacked in Table 1 are listed). The network constructed at the level of $\alpha=0.01$ is more fruitful (692 links) but the confidence degree is lower. Thus the present study focuses on the results at the level $\alpha=0.005$.

The results of network type detection of Fig. 1 are as follows:

Skewness of degree distribution: 0.1341

Aggregation index of the network: 1.5407

It is a complex network.

Variation coefficient H of the network: 6.1152

Entropy E of the network: 48.0418

It is a complex network.

Binomial distribution Chi-square=46.6529

Binomial p=0.242

It is likely not a random network

Poisson distribution Chi-square=38578.6158

Poisson distribution lamda=9.392

It is likely not a random network

Exponential distribution Chi-square=44.3965

Exponential distribution lamda=0.10647

It is not an exponentially distributed network

Power law distribution Kolmogorov-Smirnov goodness-of-fit statistic D=0.13889

Node degrees are power-law distributed, it is a scale-free complex network

Power law alpha=2.8498

Power law xmin=7

It is shown that the relational network for meridians/ collaterals and functions is a scale-free complex network. Node degrees follow power-law distribution with density function $p(x)=x^{-2.8498}$, $x \geq 7$.

The network has 6 connected components with 5 components having 1 node (attribute; isolate node) respectively.

3.1.2 Relational network for chemical composition and meridians and collaterals

The relational network for chemical composition-meridians and collaterals is one of the sub-networks to represent pharmacological mechanisms. Fig. 2 shows the relational network for chemical composition and meridians and collaterals. The results of network type detection are as follows:

Skewness of degree distribution: 0.39564

Aggregation index of the network: 1.1963

It is a complex network.

Variation coefficient H of the network: 1.803

Entropy E of the network: 3.2121

It is a complex network.

Binomial distribution Chi-square=40.9913

Binomial p=0.41176

It is likely not a random network

Poisson distribution Chi-square=52.2854

Poisson distribution lamda=4

It is likely not a random network

Exponential distribution Chi-square=9.9663

Exponential distribution lamda=0.25

Node degrees are exponentially distributed.

Power law distribution Kolmogorov-Smirnov goodness-of-fit statistic D=0.22899

Node degrees are power-law distributed, it is a scale-free complex network

Power law alpha=4.0365

Power law xmin=4

It is shown that the relational network for meridians/ collaterals and functions is a scale-free complex network. Node degrees follow power-law distribution with density function $p(x)=x^{-4.0365}$, $x \geq 4$.

The network has 3 connected components with 2 components having 1 node (attribute; isolate node) respectively.

3.1.3 Relational network for meridians and collaterals and medicinal functions

The relational network for meridians and collaterals and medicinal functions represents the self-organization structure of human body. Fig. 3 shows the relational network for meridians and collaterals and medicinal functions. The results of network type detection are as follows:

Skewness of degree distribution: 0.21331

Aggregation index of the network: 1.4401

It is a complex network.

Variation coefficient H of the network: 3.7343

Entropy E of the network: 16.8312

It is a complex network.

Binomial distribution Chi-square=28.1421

Binomial p=0.24306

It is likely not a random network

Poisson distribution Chi-square=2409.9121

Poisson distribution lamda=6.1556

It is likely not a random network

Exponential distribution Chi-square=29.5096

Exponential distribution lamda=0.16245

It is not an exponentially distributed network

Power law distribution Kolmogorov-Smirnov goodness-of-fit statistic D=0.13061

Node degrees are power-law distributed, it is a scale-free complex network

Power law alpha=5.1216

Power law xmin=13

It is indicated that the relational network for meridians and collaterals and functions is a scale-free complex network. Node degrees follow power-law distribution with density function $p(x)=x^{-5.1216}$, $x \geq 13$.

3.1.4 Relational network for meridians and collaterals

The relational network for meridians and collaterals represents the self-organization structure of human body. Fig. 4 shows the relational network for meridians/collaterals. The results of network type detection are as follows:

Skewness of degree distribution: 0.82988

Aggregation index of the network: 0.93793

It is a random network.

Variation coefficient H of the network: 0.83636

Entropy E of the network: -0.40909

It is a random network.

Binomial distribution Chi-square=1.874

Binomial p=0.52083

Node degrees are binomially distributed. It is a random network.

Poisson distribution Chi-square=0.25099

Poisson distribution lamda=2.5

Node degrees are Poisson distributed. It is a random network.

Exponential distribution Chi-square=22.1263

Exponential distribution lamda=0.4

It is not an exponentially distributed network

Power law distribution Kolmogorov-Smirnov goodness-of-fit statistic $D=0.31215$

Node degrees are power-law distributed, it is a scale-free complex network

Power law $\alpha=3.5576$

Power law $x_{min}=2$

It is shown that the relational network for meridians and collaterals is a network between random and complex networks. Node degrees follow power-law distribution with the density function $p(x)=x^{-3.5576}$, $x \geq 2$. The network has 3 connected components, of which 1 component having 1 node (attribute; isolate node) and 1 component having 2 nodes.

Table 1 Pairwise attributes and point correlations with statistic significance ($\alpha=0.005$).

Attribute	属性	Attribute	属性	r	Attribute	属性	Attribute	属性	r
Bitter	苦	Sweet	甘	-0.4051	Anthracene or quinones	蒽类/醌类	Antihypertension	降压	0.1541
Bitter	苦	Light	淡	-0.211	Tannins	鞣质类	Astringe intestine	涩肠	0.1491
Bitter	苦	Sour	酸	-0.2008	Tannins	鞣质类	Stop bleeding	止血	0.1389
Bitter	苦	Cold	寒	0.2463	Tannins	鞣质类	Promote astringent function	收敛	0.1453
Bitter	苦	Temperate	平	-0.1084	Vitamins	维生素类	Inorganic substances	无机物	0.3848
Bitter	苦	Warm	温	-0.1917	Vitamins	维生素类	Strengthen and reinforce spleen	健脾/补脾	0.1078
Bitter	苦	Toxic	毒	0.1775	Vitamins	维生素类	Promote secretion of saliva or body	生津	0.1504
Bitter	苦	Alkaloids	生物碱类	0.117	Vitamins	维生素类	Antiatherosclerosis	降血脂	0.1264
Bitter	苦	Proteins or amino acids	蛋白质/氨基酸类	-0.1109	Vitamins	维生素类	Anti-aging	抗衰老	0.1264
Bitter	苦	Aldehydes	醛类	-0.1062	Vitamins	维生素类	Relieve pain	止痛	-0.1265
Bitter	苦	Olefins	烯类	-0.1064	Vitamins	维生素类	Quench ones thirst	止渴	0.1164
Bitter	苦	Vitamins	维生素类	-0.1808	Vitamins	维生素类	Relieve summer-heat	解暑/消暑	0.1164
Bitter	苦	Spleen meridians and collaterals	脾	-0.1137	Inorganic substances	无机物	Strengthen and reinforce spleen	健脾/补脾	0.1516
Bitter	苦	Consolidate or warm kidney	补肾/温肾	-0.111	Inorganic substances	无机物	Stop diarrhea	止泻	0.1235
Bitter	苦	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	-0.1194	Inorganic substances	无机物	Antiatherosclerosis	降血脂	0.1264
Bitter	苦	Whet the appetite or reinforce stomach	开胃/益胃	-0.1729	Inorganic substances	无机物	Relieve pain	止痛	-0.1146
Bitter	苦	Strengthen and reinforce spleen	健脾/补脾	-0.1187	Liver meridians and collaterals	肝	Lung meridians and collaterals	肺	-0.2843
Bitter	苦	Nourish, warm spleen, stomach or Qi	温中/和中/补中	-0.1502	Liver meridians and collaterals	肝	Stomach meridians and collaterals	胃	-0.1819
Bitter	苦	Clear away heat	清热	0.17	Liver meridians and collaterals	肝	Large intestine meridians and collaterals	大肠	-0.1483
Bitter	苦	Detoxification	解毒	0.1069	Liver meridians and collaterals	肝	Small intestine meridians and collaterals	小肠	-0.1283
Bitter	苦	Decrease internal heat	降火	0.1271	Liver meridians and collaterals	肝	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens	清肝/补肝/舒肝/明目/退翳	0.235
Bitter	苦	Dispel endogenous cold	祛寒	-0.1487	Liver meridians and collaterals	肝	Strengthen bones and muscles	强筋骨	0.1337
Symplectic	辛	Sweet	甘	-0.3608	Liver meridians and collaterals	肝	Remove lung-heat or nourish lung	清肺/润肺	-0.1579
Symplectic	辛	Light	淡	-0.1752	Liver meridians and collaterals	肝	Eliminate or relieve phlegm	祛痰/化痰	-0.1488
Symplectic	辛	Sour	酸	-0.1646	Liver meridians and collaterals	肝	Anti-asthma	平喘/定喘	-0.1111
Symplectic	辛	Astringent	涩	-0.1872	Liver meridians and collaterals	肝	Whet the appetite or reinforce stomach	开胃/益胃	-0.1211
Symplectic	辛	Cold	寒	-0.2817	Liver meridians and collaterals	肝	Strengthen and reinforce spleen	健脾/补脾	-0.1729
Symplectic	辛	Cool	凉	-0.1142	Liver meridians and collaterals	肝	Promote secretion of saliva or body	生津	-0.1026
Symplectic	辛	Warm	温	0.4221	Liver meridians and collaterals	肝	Relieve sore throat	利咽	-0.1068
Symplectic	辛	Hot	热	0.1452	Liver meridians and collaterals	肝	Strengthen heart or clean heart-fire	强心/清心	-0.1259
Symplectic	辛	Toxic	毒	0.1639	Liver meridians and collaterals	肝	Cool blood	凉血	0.105
Symplectic	辛	Volatile oils or ordinary oils	挥发油类/油类	0.2202	Liver meridians and collaterals	肝	Stop bleeding	止血	0.1121
Symplectic	辛	Phenols	酚类	0.1104	Liver meridians and collaterals	肝	Invigorate blood circulation	活血	0.2046

Symplectic	辛	Aldehydes	醛类	0.1305	Liver meridians and collaterals	肝	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化痰/消癰/敛疮	0.1822
Symplectic	辛	Carbohydrates or starch	糖类/淀粉	-0.1197	Liver meridians and collaterals	肝	Regulate menstruation or promote blood flow	调经/通淋	0.1513
Symplectic	辛	Alcohols	醇类	0.1508	Liver meridians and collaterals	肝	Inhibit or break energy flow (Qi)	下气/破气	-0.1269
Symplectic	辛	Olefins	烯类	0.2366	Liver meridians and collaterals	肝	Nourish, warm spleen, stomach or Qi	温中/和中/补中	-0.16
Symplectic	辛	Spleen meridians and collaterals	脾	0.1533	Liver meridians and collaterals	肝	Relieve pain	止痛	0.1267
Symplectic	辛	Large intestine meridians and collaterals	大肠	-0.1037	Liver meridians and collaterals	肝	Dispel endogenous wind	祛风	0.1331
Symplectic	辛	Induce diuresis or treat strangury	利尿/通淋	-0.1474	Liver meridians and collaterals	肝	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1242
Symplectic	辛	Eliminate or relieve phlegm	祛痰/化痰	0.1013	Liver meridians and collaterals	肝	Relieve external syndrome	解表/发表	-0.1116
Symplectic	辛	Promote secretion of saliva or body	生津	-0.1488	Gallbladder meridians and collaterals	胆	Triple burner	三焦	0.2137
Symplectic	辛	Relieve constipation	通便	-0.1456	Gallbladder meridians and collaterals	胆	Benefit gallbladder or cure jaundice	利胆/退黄	0.1471
Symplectic	辛	Loosen the bowels	润肠	-0.1093	Gallbladder meridians and collaterals	胆	Prevent or arrest vomiting	止呕	0.1038
Symplectic	辛	Cool blood	凉血	-0.1166	Gallbladder meridians and collaterals	胆	Prevent miscarriage or abortion	安胎	0.1252
Symplectic	辛	Tonify blood	养血/补血	-0.1272	Gallbladder meridians and collaterals	胆	Dry dampness	燥湿	0.1222
Symplectic	辛	Nourish essential fluid (Yin)	滋阴	-0.1011	Urinary bladder meridians and collaterals	膀胱	Spleen meridians and collaterals	脾	-0.1246
Symplectic	辛	Regulate or enhance energy flow (Qi)	理气/养气	0.17	Urinary bladder meridians and collaterals	膀胱	Stomach meridians and collaterals	胃	-0.1016
Symplectic	辛	Inhibit or break energy flow (Qi)	下气/破气	0.1196	Urinary bladder meridians and collaterals	膀胱	Induce diuresis or treat strangury	利尿/通淋	0.3091
Symplectic	辛	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1909	Urinary bladder meridians and collaterals	膀胱	Activate water metabolism or excrete water	利水/行水	0.1186
Symplectic	辛	Relieve pain	止痛	0.2118	Urinary bladder meridians and collaterals	膀胱	Dispel evil spirit	逐邪	0.1219
Symplectic	辛	Clear away heat	清热	-0.2949	Kidney meridians and collaterals	肾	Lung meridians and collaterals	肺	-0.1467
Symplectic	辛	Eliminate dampness	利湿	-0.1128	Kidney meridians and collaterals	肾	Stomach meridians and collaterals	胃	-0.2019
Symplectic	辛	Detoxification	解毒	-0.1499	Kidney meridians and collaterals	肾	Large intestine meridians and collaterals	大肠	-0.1538
Symplectic	辛	Decrease internal heat	降火	-0.1245	Kidney meridians and collaterals	肾	Consolidate or warm kidney	补肾/温肾	0.4801
Symplectic	辛	Dispel endogenous cold	祛寒	0.26	Kidney meridians and collaterals	肾	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.3026
Symplectic	辛	Dispel endogenous damp	祛湿	0.1815	Kidney meridians and collaterals	肾	Strengthen bones and muscles	强筋骨	0.2189
Symplectic	辛	Dispel endogenous wind	祛风	0.2155	Kidney meridians and collaterals	肾	Stop diarrheal	止泻	0.1352
Symplectic	辛	Relieve external syndrome	解表/发表	0.1351	Kidney meridians and collaterals	肾	Regulate menstruation or promote blood flow	调经/通淋	0.1155
Symplectic	辛	Promote astringent function	收敛	-0.1035	Kidney meridians and collaterals	肾	Clear away heat	清热	-0.1137
Sweet	甘	Light	淡	0.1573	Kidney meridians and collaterals	肾	Detoxification	解毒	-0.1206
Sweet	甘	Temperate	平	0.1831	Kidney meridians and collaterals	肾	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1179
Sweet	甘	Warm	温	-0.1274	Lung meridians and collaterals	肺	Spleen meridians and collaterals	脾	-0.1437
Sweet	甘	Toxic	毒	-0.1999	Lung meridians and collaterals	肺	Consolidate or warm kidney	补肾/温肾	-0.139
Sweet	甘	Organic acids	有机酸类	0.1033	Lung meridians and collaterals	肺	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	-0.1076
Sweet	甘	Sterols	甾醇类	0.1027	Lung meridians and collaterals	肺	Strengthen bones and muscles	强筋骨	-0.1364
Sweet	甘	Proteins or amino acids	蛋白质/氨基酸类	0.1239	Lung meridians and collaterals	肺	Remove lung-heat or nourish lung	清肺/润肺	0.2941
Sweet	甘	Carbohydrates or starch	糖类/淀粉	0.1415	Lung meridians and collaterals	肺	Eliminate or relieve phlegm	祛痰/化痰	0.2825
Sweet	甘	Olefins	烯类	-0.1307	Lung meridians and collaterals	肺	Anti-asthma	平喘/定喘	0.2014
Sweet	甘	Vitamins	维生素类	0.1848	Lung meridians and collaterals	肺	Eliminate or relieve cough	止咳	0.263
Sweet	甘	Kidney meridians and collaterals	肾	0.1463	Lung meridians and collaterals	肺	Stop diarrheal	止泻	-0.1082
Sweet	甘	Consolidate or warm kidney	补肾/温肾	0.1438	Lung meridians and collaterals	肺	Tonify blood	养血/补血	-0.1014
Sweet	甘	Induce diuresis or treat strangury	利尿/通淋	0.1176	Lung meridians and collaterals	肺	Invigorate blood circulation	活血	-0.1307
Sweet	甘	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.1386	Lung meridians and collaterals	肺	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化痰/消癰/敛疮	-0.1076
Sweet	甘	Remove lung-heat or nourish lung	清肺/润肺	0.1544	Lung meridians and collaterals	肺	Regulate menstruation or promote blood flow	调经/通淋	-0.1063
Sweet	甘	Strengthen and reinforce spleen	健脾/补脾	0.198	Lung meridians and collaterals	肺	Clear away heat	清热	0.1228
Sweet	甘	Promote secretion of saliva or body	生津	0.2125	Lung meridians and collaterals	肺	Detoxification	解毒	0.1489

Sweet	甘	Loosen the bowels	润肠	0.1404	Lung meridians and collaterals	肺	Dispel endogenous damp	祛湿	-0.1111
Sweet	甘	Moisten dryness	润燥	0.14	Lung meridians and collaterals	肺	Relieve external syndrome	解表/发表	0.1223
Sweet	甘	Tonify blood	养血/补血	0.1283	Spleen meridians and collaterals	脾	Stomach meridians and collaterals	胃	0.104
Sweet	甘	Nourish essential fluid (Yin)	滋阴	0.1597	Spleen meridians and collaterals	脾	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.1017
Sweet	甘	Relieve pain	止痛	-0.2017	Spleen meridians and collaterals	脾	Whet the appetite or reinforce stomach	开胃/益胃	0.196
Sweet	甘	Dispel endogenous cold	祛寒	-0.1331	Spleen meridians and collaterals	脾	Strengthen and reinforce spleen	健脾/补脾	0.3217
Sweet	甘	Dispel endogenous wind	祛风	-0.1174	Spleen meridians and collaterals	脾	Improve digestion	消食/化食	0.1684
Sweet	甘	Dry dampness	燥湿	-0.1144	Spleen meridians and collaterals	脾	Prevent or arrest vomiting	止呕	0.1168
Sweet	甘	Relieve itching	止痒	-0.1265	Spleen meridians and collaterals	脾	Stop diarrheal	止泻	0.1412
Sweet	甘	Kill or expel parasites	杀虫/驱虫	-0.1224	Spleen meridians and collaterals	脾	Regulate or enhance energy flow (Qi)	理气/养气	0.1916
Light	淡	Cool	凉	0.187	Spleen meridians and collaterals	脾	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2126
Light	淡	Warm	温	-0.1247	Spleen meridians and collaterals	脾	Clear away heat	清热	-0.1808
Light	淡	Sterols	甾醇类	0.1218	Spleen meridians and collaterals	脾	Detoxification	解毒	-0.127
Light	淡	Small intestine meridians and collaterals	小肠	0.1567	Spleen meridians and collaterals	脾	Dispel endogenous cold	祛寒	0.1226
Light	淡	Eliminate dampness	利湿	0.1925	Stomach meridians and collaterals	胃	Heart meridians and collaterals	心	-0.1082
Sour	酸	Astringent	涩	0.14	Stomach meridians and collaterals	胃	Consolidate or warm kidney	补肾/温肾	-0.1256
Sour	酸	Temperate	平	0.109	Stomach meridians and collaterals	胃	Whet the appetite or reinforce stomach	开胃/益胃	0.2722
Sour	酸	Organic acids	有机酸类	0.1683	Stomach meridians and collaterals	胃	Strengthen and reinforce spleen	健脾/补脾	0.1454
Sour	酸	Vitamins	维生素类	0.2357	Stomach meridians and collaterals	胃	Improve digestion	消食/化食	0.2174
Sour	酸	Promote secretion of saliva or body	生津	0.1763	Stomach meridians and collaterals	胃	Promote secretion of saliva or body	生津	0.1217
Sour	酸	Astringe intestine	涩肠	0.2838	Stomach meridians and collaterals	胃	Resolve food stagnation	消积/消滞	0.1456
Astringent	涩	Tannins	鞣质类	0.1336	Stomach meridians and collaterals	胃	Prevent or arrest vomiting	止呕	0.1585
Astringent	涩	Astringe intestine	涩肠	0.1782	Stomach meridians and collaterals	胃	Regulate menstruation or promote blood flow	调经/通淋	-0.1016
Astringent	涩	Antidiarrheal	止痢	0.1711	Stomach meridians and collaterals	胃	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2408
Astringent	涩	Stop diarrheal	止泻	0.2077	Stomach meridians and collaterals	胃	Relieve summer-heat	解暑/消暑	0.1552
Astringent	涩	Stop bleeding	止血	0.2336	Stomach meridians and collaterals	胃	Relieve external syndrome	解表/发表	0.1165
Astringent	涩	Promote astringent function	收敛	0.3186	Heart meridians and collaterals	心	Large intestine meridians and collaterals	大肠	-0.1238
Salty	咸	Soften hardness or dissolve masses	散结/软坚	0.2018	Heart meridians and collaterals	心	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens	清肝/补肝/舒肝/明目/退翳	-0.1216
Cold	寒	Cool	凉	-0.3045	Heart meridians and collaterals	心	Strengthen heart or clean heart-fire	强心/清心	0.2542
Cold	寒	Temperate	平	-0.3696	Heart meridians and collaterals	心	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	除烦/安神/解郁/定惊	0.2545
Cold	寒	Warm	温	-0.4128	Large intestine meridians and collaterals	大肠	Small intestine meridians and collaterals	小肠	0.121
Cold	寒	Alkaloids	生物碱类	0.1306	Large intestine meridians and collaterals	大肠	Resolve food stagnation	消积/消滞	0.1427
Cold	寒	Volatile oils or ordinary oils	挥发油类/油类	-0.1671	Large intestine meridians and collaterals	大肠	Relieve constipation	通便	0.2013
Cold	寒	Olefins	烯类	-0.1036	Large intestine meridians and collaterals	大肠	Loosen the bowels	润肠	0.2886
Cold	寒	Urinary bladder meridians and collaterals	膀胱	0.1374	Large intestine meridians and collaterals	大肠	Astringe intestine	涩肠	0.171
Cold	寒	Kidney meridians and collaterals	肾	-0.1103	Large intestine meridians and collaterals	大肠	Antidiarrheal	止痢	0.1165
Cold	寒	Spleen meridians and collaterals	脾	-0.1549	Large intestine meridians and collaterals	大肠	Invigorate blood circulation	活血	-0.1071
Cold	寒	Small intestine meridians and collaterals	小肠	0.1202	Large intestine meridians and collaterals	大肠	Decrease internal heat	降火	0.1021
Cold	寒	Consolidate or warm kidney	补肾/温肾	-0.1537	Large intestine meridians and collaterals	大肠	Dispel endogenous wind	祛风	-0.1167
Cold	寒	Induce diuresis or treat strangurt	利尿/通淋	0.1657	Large intestine meridians and collaterals	大肠	Dry dampness	燥湿	0.1357
Cold	寒	Strengthen bones and muscles	强筋骨	-0.1223	Large intestine meridians and collaterals	大肠	Kill or expel parasites	杀虫/驱虫	0.1018
Cold	寒	Whet the appetite or reinforce stomach	开胃/益胃	-0.1209	Small intestine meridians and collaterals	小肠	Induce diuresis or treat strangurt	利尿/通淋	0.1739
Cold	寒	Strengthen and reinforce spleen	健脾/补脾	-0.1237	Small intestine meridians and collaterals	小肠	Activate water metabolism or excrete water	利水/行水	0.1281
Cold	寒	Relieve constipation	通便	0.1066	Small intestine meridians and collaterals	小肠	Clear away heat	清热	0.109

Cold	寒	Soften hardness or dissolve masses	散结/软坚	0.1164	Blood phase	血分	Relieve sore throat	利咽	0.265
Cold	寒	Cool blood	凉血	0.1651	Blood phase	血分	Cool blood	凉血	0.1188
Cold	寒	Invigorate blood circulation	活血	-0.1265	Triple burner	三焦	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	0.1545
Cold	寒	Regulate or enhance energy flow (Qi)	理气/养气	-0.1749	Triple burner	三焦	Regulate or enhance energy flow (Qi)	理气/养气	0.1119
Cold	寒	Nourish, warm spleen, stomach or Qi	温中/和中/补中	-0.1547	Triple burner	三焦	Decrease internal heat	降火	0.1037
Cold	寒	Relieve pain	止痛	-0.129	Clean liver, relax liver, consolidate liver, bright eyes or	清肝/补肝/舒肝/明目/退翳	Consolidate or warm kidney	补肾/温肾	0.2956
Cold	寒	Clear away heat	清热	0.4167	Clean liver, relax liver, consolidate liver, bright eyes or	清肝/补肝/舒肝/明目/退翳	Strengthen bones and muscles	强筋骨	0.155
Cold	寒	Detoxification	解毒	0.2518	Clean liver, relax liver, consolidate liver, bright eyes or	清肝/补肝/舒肝/明目/退翳	Prevent miscarriage or abortion	安胎	0.1355
Cold	寒	Decrease internal heat	降火	0.1974	Clean liver, relax liver, consolidate liver, bright eyes or	清肝/补肝/舒肝/明目/退翳	Detoxification	解毒	-0.1391
Cold	寒	Dispel endogenous cold	祛寒	-0.1589	Breed or blacked hair	生发/乌发	Tonify blood	养血/补血	0.161
Cold	寒	Dispel endogenous damp	祛湿	-0.1524	Breed or blacked hair	生发/乌发	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1133
Cold	寒	Dispel endogenous wind	祛风	-0.1396	Consolidate or warm kidney	补肾/温肾	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.4933
Cool	凉	Temperate	平	-0.2151	Consolidate or warm kidney	补肾/温肾	Strengthen bones and muscles	强筋骨	0.2865
Cool	凉	Warm	温	-0.272	Consolidate or warm kidney	补肾/温肾	Strengthen and reinforce spleen	健脾/补脾	0.1389
Cool	凉	Cool blood	凉血	0.1518	Consolidate or warm kidney	补肾/温肾	Stop diarrheal	止泻	0.1312
Cool	凉	Clear away heat	清热	0.2518	Consolidate or warm kidney	补肾/温肾	Prevent miscarriage or abortion	安胎	0.1725
Cool	凉	Eliminate dampness	利湿	0.1638	Consolidate or warm kidney	补肾/温肾	Clear away heat	清热	-0.1794
Cool	凉	Detoxification	解毒	0.1853	Consolidate or warm kidney	补肾/温肾	Detoxification	解毒	-0.177
Temperate	平	Warm	温	-0.3361	Induce diuresis or treat strangurt	利尿/通淋	Strengthen heart or clean heart-fire	强心/清心	0.1871
Temperate	平	Olefins	烯类	-0.114	Induce diuresis or treat strangurt	利尿/通淋	Antiatherosclerosis	降血脂	0.1067
Temperate	平	Urinary bladder meridians and collaterals	膀胱	-0.1073	Induce diuresis or treat strangurt	利尿/通淋	Clear away heat	清热	0.1205
Temperate	平	Strengthen and reinforce spleen	健脾/补脾	0.128	Activate water metabolism or excrete water	利水/行水	Reduce swelling	消肿	0.1918
Temperate	平	Cool blood	凉血	-0.1127	Activate water metabolism or excrete water	利水/行水	Kill or expel parasites	杀虫/驱虫	0.1294
Temperate	平	Invigorate blood circulation	活血	0.1123	Activate water metabolism or excrete water	利水/行水	Dispel evil spirit	逐邪	0.1383
Temperate	平	Clear away heat	清热	-0.1663	Invigorate male impotence (Yang) or strengthen male	壮阳/温阳/益精	Stop diarrheal	止泻	0.2727
Temperate	平	Dispel endogenous cold	祛寒	-0.1294	Invigorate male impotence (Yang) or strengthen male	壮阳/温阳/益精	Relieve external syndrome	解表/发表	0.1335
Temperate	平	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1196	Invigorate male impotence (Yang) or strengthen male	壮阳/温阳/益精	Expose exanthema or promote eruption	透疹	0.1389
Warm	温	Volatile oils or ordinary oils	挥发油类/油类	0.2755	Strengthen bones and muscles	强筋骨	Tonify blood	养血/补血	0.1022
Warm	温	Aldehydes	醛类	0.1283	Strengthen bones and muscles	强筋骨	Prevent miscarriage or abortion	安胎	0.1118
Warm	温	Esters or fats	酯类/脂肪	0.132	Strengthen bones and muscles	强筋骨	Clear away heat	清热	-0.1408
Warm	温	Alcohols	醇类	0.1428	Strengthen bones and muscles	强筋骨	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.2508
Warm	温	Ethers	醚类	0.1269	Remove lung-heat or nourish lung	清肺/润肺	Eliminate or relieve cough	止咳	0.1956
Warm	温	Olefins	烯类	0.2652	Remove lung-heat or nourish lung	清肺/润肺	Promote secretion of saliva or body	生津	0.2021
Warm	温	Spleen meridians and collaterals	脾	0.1431	Remove lung-heat or nourish lung	清肺/润肺	Relieve sore throat	利咽	0.1822
Warm	温	Consolidate or warm kidney	补肾/温肾	0.1998	Remove lung-heat or nourish lung	清肺/润肺	Loosen the bowels	润肠	0.1284
Warm	温	Induce diuresis or treat strangurt	利尿/通淋	-0.128	Remove lung-heat or nourish lung	清肺/润肺	Astringe intestine	涩肠	0.1283
Warm	温	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.1265	Remove lung-heat or nourish lung	清肺/润肺	Nourish essential fluid (Yin)	滋阴	0.2319
Warm	温	Strengthen bones and muscles	强筋骨	0.1649	Remove lung-heat or nourish lung	清肺/润肺	Inhibit or break energy flow (Qi)	下气/破气	0.1235
Warm	温	Eliminate or relieve stuffy nose	通鼻窍	0.1029	Remove lung-heat or nourish lung	清肺/润肺	Relieve pain	止痛	-0.1265
Warm	温	Whet the appetite or reinforce stomach	开胃/益胃	0.154	Remove lung-heat or nourish lung	清肺/润肺	Detoxification	解毒	-0.1046
Warm	温	Improve digestion	消食/化食	0.1045	Remove lung-heat or nourish lung	清肺/润肺	Dispel endogenous damp	祛湿	-0.1093
Warm	温	Cool blood	凉血	-0.1841	Remove lung-heat or nourish lung	清肺/润肺	Dispel evil spirit	逐邪	0.1264
Warm	温	Regulate or enhance energy flow (Qi)	理气/养气	0.2191	Eliminate or relieve phlegm	祛痰/化痰	Eliminate or relieve cough	止咳	0.3289
Warm	温	Inhibit or break energy flow (Qi)	下气/破气	0.1168	Eliminate or relieve phlegm	祛痰/化痰	Soften hardness or dissolve masses	散结/软坚	0.1644

Warm	温	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2397	Eliminate or relieve phlegm	祛痰/化痰	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化痰/消痈/敛疮	-0.1086
Warm	温	Relieve pain	止痛	0.2316	Eliminate or relieve phlegm	祛痰/化痰	Inhibit or break energy flow (Qi)	下气/破气	0.1895
Warm	温	Clear away heat	清热	-0.449	Anti-asthma	平喘/定喘	Eliminate or relieve cough	止咳	0.4146
Warm	温	Eliminate dampness	利湿	-0.1464	Anti-asthma	平喘/定喘	Antidiabetics	降糖	0.1152
Warm	温	Detoxification	解毒	-0.3226	Anti-asthma	平喘/定喘	Antiatherosclerosis	降血脂	0.1704
Warm	温	Decrease internal heat	降火	-0.1134	Anti-asthma	平喘/定喘	Anticancer	抗癌	0.2001
Warm	温	Dispel endogenous cold	祛寒	0.2796	Anti-asthma	平喘/定喘	Dispel evil spirit	逐邪	0.1704
Warm	温	Dispel endogenous damp	祛湿	0.1426	Eliminate or relieve cough	止咳	Antiatherosclerosis	降血脂	0.1067
Warm	温	Dispel endogenous wind	祛风	0.1514	Eliminate or relieve cough	止咳	Anti-aging	抗衰老	0.1067
Warm	温	Induce perspiration	发汗	0.133	Eliminate or relieve cough	止咳	Anticancer	抗癌	0.1161
Hot	热	Toxic	毒	0.2096	Eliminate or relieve stuffy nose	通鼻窍	Dispel endogenous cold	祛寒	0.1733
Hot	热	Amines	胺类	0.1215	Eliminate or relieve tuberculosis	祛肺结核	Improve digestion	消食/化食	0.1216
Hot	热	Alkanes or hydrocarbons	烷类/烃类	0.1119	Eliminate or relieve tuberculosis	祛肺结核	Soften hardness or dissolve masses	散结/软坚	0.1194
Hot	热	Spleen meridians and collaterals	脾	0.1281	Eliminate or relieve tuberculosis	祛肺结核	Reduce swelling	消肿	0.1073
Hot	热	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.1459	Eliminate or relieve tuberculosis	祛肺结核	Discharge pus, diminish inflammation or anti-infection	排脓/消炎/抗感染	0.1194
Hot	热	Dispel endogenous cold	祛寒	0.2748	Whet the appetite or reinforce stomach	开胃/益胃	Strengthen and reinforce spleen	健脾/补脾	0.2521
Toxic	毒	Alkaloids	生物碱类	0.2361	Whet the appetite or reinforce stomach	开胃/益胃	Improve digestion	消食/化食	0.339
Toxic	毒	Activate water metabolism or excrete water	利水/行水	0.1376	Whet the appetite or reinforce stomach	开胃/益胃	Promote secretion of saliva or body	生津	0.1595
Toxic	毒	Anti-asthma	平喘/定喘	0.1038	Whet the appetite or reinforce stomach	开胃/益胃	Regulate or enhance energy flow (Qi)	理气/养气	0.1651
Toxic	毒	Soften hardness or dissolve masses	散结/软坚	0.149	Whet the appetite or reinforce stomach	开胃/益胃	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1254
Toxic	毒	Reduce swelling	消肿	0.1285	Whet the appetite or reinforce stomach	开胃/益胃	Clear away heat	清热	-0.1479
Toxic	毒	Relieve pain	止痛	0.129	Whet the appetite or reinforce stomach	开胃/益胃	Detoxification	解毒	-0.1559
Toxic	毒	Kill or expel parasites	杀虫/驱虫	0.2268	Whet the appetite or reinforce stomach	开胃/益胃	Relieve summer-heat	解暑/消暑	0.1224
Glycosides	甙类	Organic acids	有机酸类	0.2044	Whet the appetite or reinforce stomach	开胃/益胃	Dispel endogenous cold	祛寒	0.1192
Glycosides	甙类	Alkaloids	生物碱类	-0.1577	Whet the appetite or reinforce stomach	开胃/益胃	Dispel endogenous wind	祛风	-0.1052
Glycosides	甙类	Volatile oils or ordinary oils	挥发油类/油类	-0.101	Strengthen and reinforce spleen	健脾/补脾	Improve digestion	消食/化食	0.1616
Glycosides	甙类	Carbohydrates or starch	糖类/淀粉	0.2124	Strengthen and reinforce spleen	健脾/补脾	Strengthen heart or clean heart-fire	强心/清心	0.1795
Glycosides	甙类	Enzymes	酶类	-0.1407	Strengthen and reinforce spleen	健脾/补脾	Stop diarrheal	止泻	0.1284
Glycosides	甙类	Prevent or arrest vomiting	止呕	-0.1097	Strengthen and reinforce spleen	健脾/补脾	Regulate or enhance energy flow (Qi)	理气/养气	0.1398
Glycosides	甙类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	-0.1049	Improve digestion	消食/化食	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1092
Glycosides	甙类	Relieve pain	止痛	-0.1111	Improve digestion	消食/化食	Clear away heat	清热	-0.1131
Organic acids	有机酸类	Alkaloids	生物碱类	-0.1889	Promote secretion of saliva or body	生津	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	0.1442
Organic acids	有机酸类	Sterols	甾醇类	0.1443	Promote secretion of saliva or body	生津	Moisten dryness	润燥	0.1689
Organic acids	有机酸类	Carbohydrates or starch	糖类/淀粉	0.1049	Promote secretion of saliva or body	生津	Astringe intestine	涩肠	0.1248
Organic acids	有机酸类	Large intestine meridians and collaterals	大肠	0.1219	Promote secretion of saliva or body	生津	Nourish essential fluid (Yin)	滋阴	0.3537
Organic acids	有机酸类	Moisten dryness	润燥	0.1083	Promote secretion of saliva or body	生津	Anti-aging	抗衰老	0.1823
Organic acids	有机酸类	Dry dampness	燥湿	-0.1095	Promote secretion of saliva or body	生津	Relieve pain	止痛	-0.1042
Alkaloids	生物碱类	Amines	胺类	0.1341	Promote secretion of saliva or body	生津	Quench ones thirst	止渴	0.1816
Alkaloids	生物碱类	Volatile oils or ordinary oils	挥发油类/油类	-0.1855	Resolve food stagnation	消积/消滞	Relieve constipation	通便	0.1335
Alkaloids	生物碱类	Carbohydrates or starch	糖类/淀粉	-0.1621	Resolve food stagnation	消积/消滞	Relieve summer-heat	解暑/消暑	0.1071
Alkaloids	生物碱类	Ketones or flavonoids	(黄)酮类	-0.141	Resolve food stagnation	消积/消滞	Kill or expel parasites	杀虫/驱虫	0.1688
Alkaloids	生物碱类	Olefins	烯类	-0.1865	Repel foulness	辟秽	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	0.1777
Alkaloids	生物碱类	Decrease internal heat	降火	0.1394	Repel foulness	辟秽	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2056
Alkaloids	生物碱类	Dry dampness	燥湿	0.1145	Prevent or arrest vomiting	止呕	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1242

Amines	胺类	Triple burner	三焦	0.142	Prevent or arrest vomiting	止呕	Dispel endogenous cold	祛寒	0.1691
Amines	胺类	Eliminate impediment	除痹	0.1206	Strengthen heart or clean heart-fire	强心/清心	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	0.2251
Sterols	甾醇类	Volatile oils or ordinary oils	挥发油类/油类	-0.1201	Strengthen heart or clean heart-fire	强心/清心	Decrease internal heat	降火	0.1052
Sterols	甾醇类	Olefins	烯类	-0.1306	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	Anticancer	抗癌	0.1585
Sterols	甾醇类	Kidney meridians and collaterals	肾	0.1095	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest	除烦/安神/解郁/定惊	Quench ones thirst	止渴	0.1308
Volatile oils or ordinary oils	挥发油类/油类	Phenols	酚类	0.1267	Relieve constipation	通便	Loosen the bowels	润肠	0.5081
Volatile oils or ordinary oils	挥发油类/油类	Aldehydes	醛类	0.2226	Relieve constipation	通便	Antiatherosclerosis	降血脂	0.1856
Volatile oils or ordinary oils	挥发油类/油类	Esters or fats	酯类/脂肪	0.1317	Loosen the bowels	润肠	Moisten dryness	润燥	0.1265
Volatile oils or ordinary oils	挥发油类/油类	Alcohols	醇类	0.1855	Loosen the bowels	润肠	Tonify blood	养血/补血	0.1799
Volatile oils or ordinary oils	挥发油类/油类	Ethers	醚类	0.1329	Loosen the bowels	润肠	Inhibit or break energy flow (Qi)	下气/破气	0.1074
Volatile oils or ordinary oils	挥发油类/油类	Olefins	烯类	0.4555	Moisten dryness	润燥	Tonify blood	养血/补血	0.1432
Volatile oils or ordinary oils	挥发油类/油类	Spleen meridians and collaterals	脾	0.1506	Moisten dryness	润燥	Nourish essential fluid (Yin)	滋阴	0.2102
Volatile oils or ordinary oils	挥发油类/油类	Triple burner	三焦	0.1226	Moisten dryness	润燥	Quench ones thirst	止渴	0.108
Volatile oils or ordinary oils	挥发油类/油类	Eliminate or relieve phlegm	祛痰/化痰	0.1017	Astringe intestine	涩肠	Stop diarrheal	止泻	0.2244
Volatile oils or ordinary oils	挥发油类/油类	Eliminate or relieve stuffy nose	通鼻窍	0.1226	Soften hardness or dissolve masses	散结/软坚	Reduce swelling	消肿	0.1413
Volatile oils or ordinary oils	挥发油类/油类	Whet the appetite or reinforce stomach	开胃/益胃	0.1241	Antidiarrheal	止痢	Anticancer	抗癌	0.1138
Volatile oils or ordinary oils	挥发油类/油类	Improve digestion	消食/化食	0.1296	Antidiarrheal	止痢	Promote astringent function	收敛	0.1616
Volatile oils or ordinary oils	挥发油类/油类	Stop bleeding	止血	-0.103	Antidiarrheal	止痢	Anti-malaria	抗疟/截疟	0.1795
Volatile oils or ordinary oils	挥发油类/油类	Regulate or enhance energy flow (Qi)	理气/养气	0.1615	Stop diarrheal	止泻	Prevent miscarriage or abortion	安胎	0.1325
Volatile oils or ordinary oils	挥发油类/油类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2395	Stop diarrheal	止泻	Detoxification	解毒	-0.1175
Volatile oils or ordinary oils	挥发油类/油类	Clear away heat	清热	-0.1731	Cool blood	凉血	Stop bleeding	止血	0.2272
Volatile oils or ordinary oils	挥发油类/油类	Detoxification	解毒	-0.1481	Cool blood	凉血	Relieve pain	止痛	-0.1373
Volatile oils or ordinary oils	挥发油类/油类	Dispel endogenous cold	祛寒	0.17	Cool blood	凉血	Clear away heat	清热	0.2204
Volatile oils or ordinary oils	挥发油类/油类	Induce perspiration	发汗	0.1186	Cool blood	凉血	Detoxification	解毒	0.1469
Proteins or amino acids	蛋白质/氨基酸类	Carbohydrates or starch	糖类/淀粉	0.2339	Cool blood	凉血	Dispel endogenous damp	祛湿	-0.1023
Proteins or amino acids	蛋白质/氨基酸类	Vitamins	维生素类	0.273	Stop bleeding	止血	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化瘀/消痈/敛疮	0.1162
Proteins or amino acids	蛋白质/氨基酸类	Inorganic substances	无机物	0.3102	Stop bleeding	止血	Relieve pain	止痛	-0.1116
Proteins or amino acids	蛋白质/氨基酸类	Liver meridians and collaterals	肝	-0.1382	Stop bleeding	止血	Promote astringent function	收敛	0.2079
Proteins or amino acids	蛋白质/氨基酸类	Blood phase	血分	0.1264	Tonify blood	养血/补血	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	0.1101
Proteins or amino acids	蛋白质/氨基酸类	Remove lung-heat or nourish lung	清肺/润肺	0.1052	Tonify blood	养血/补血	Clear away heat	清热	-0.1011
Proteins or amino acids	蛋白质/氨基酸类	Strengthen and reinforce spleen	健脾/补脾	0.1516	Tonify blood	养血/补血	Suppress perspiration	止汗	0.161
Proteins or amino acids	蛋白质/氨基酸类	Relieve sore throat	利咽	0.1086	Invigorate blood circulation	活血	Regulate menstruation or promote blood flow	调经/通淋	0.1986
Proteins or amino acids	蛋白质/氨基酸类	Anti-aging	抗衰老	0.1264	Invigorate blood circulation	活血	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	0.1079
Terpenoids	萜类	Stomach meridians and collaterals	胃	-0.1163	Invigorate blood circulation	活血	Relieve pain	止痛	0.1588
Terpenoids	萜类	Relieve itching	止痒	0.1227	Invigorate blood circulation	活血	Clear away heat	清热	-0.1202
Phenols	酚类	Aldehydes	醛类	0.119	Invigorate blood circulation	活血	Dispel endogenous wind	祛风	0.1116
Phenols	酚类	Ketones or flavonoids	(黄)酮类	0.1284	Absorb clots, eliminate stasis, resolve carbuncle or promote	化瘀/消痈/敛疮	Reduce swelling	消肿	0.1104
Phenols	酚类	Olefins	烯类	0.1543	Reduce swelling	消肿	Regulate or enhance energy flow (Qi)	理气/养气	-0.1444
Phenols	酚类	Stop bleeding	止血	0.1032	Reduce swelling	消肿	Detoxification	解毒	0.2008
Aldehydes	醛类	Alcohols	醇类	0.22	Antidiabetics	降糖	Nourish essential fluid (Yin)	滋阴	0.1521
Aldehydes	醛类	Ketones or flavonoids	(黄)酮类	0.1474	Antihypertension	降压	Prevent miscarriage or abortion	安胎	0.1366
Aldehydes	醛类	Ethers	醚类	0.1014	Antihypertension	降压	Promote astringent function	收敛	0.1081
Aldehydes	醛类	Olefins	烯类	0.26	Prevent miscarriage or abortion	安胎	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1027
Aldehydes	醛类	Spleen meridians and collaterals	脾	0.1138	Prevent miscarriage or abortion	安胎	Dry dampness	燥湿	0.1118

Aldehydes	醛类	Eliminate or relieve phlegm	祛痰/化痰	0.1044	Prevent miscarriage or abortion 安胎	Suppress perspiration	止汗	0.2464	
Aldehydes	醛类	Prevent or arrest vomiting	止呕	0.2037	Regulate or enhance energy flow (Qi)	理气/养气	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1897
Aldehydes	醛类	Reduce swelling	消肿	-0.1049	Regulate or enhance energy flow (Qi)	理气/养气	Relieve pain	止痛	0.2089
Aldehydes	醛类	Regulate or enhance energy flow (Qi)	理气/养气	0.1086	Regulate or enhance energy flow (Qi)	理气/养气	Clear away heat	清热	-0.1913
Aldehydes	醛类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.129	Regulate or enhance energy flow (Qi)	理气/养气	Detoxification	解毒	-0.1709
Aldehydes	醛类	Dispel endogenous cold	祛寒	0.1011	Regulate or enhance energy flow (Qi)	理气/养气	Dispel endogenous cold	祛寒	0.106
Esters or fats	酯类/脂肪	Alcohols	醇类	0.1233	Inhibit or break energy flow (Qi)	下气/破气	Clear away heat	清热	-0.1033
Esters or fats	酯类/脂肪	Olefins	烯类	0.1568	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	Dispel endogenous wind	祛风	0.1835
Esters or fats	酯类/脂肪	Spleen meridians and collaterals	脾	0.1026	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	Relieve rheumatism or lubricate the joints	祛风湿/利关节	0.1106
Esters or fats	酯类/脂肪	Strengthen and reinforce spleen	健脾/补脾	0.1046	Nourish, warm spleen, stomach or Qi	温中/和中/补中	Clear away heat	清热	-0.1626
Carbohydrates or starch	糖类/淀粉	Vitamins	维生素类	0.1998	Nourish, warm spleen, stomach or Qi	温中/和中/补中	Detoxification	解毒	-0.1607
Carbohydrates or starch	糖类/淀粉	Relieve pain	止痛	-0.1146	Nourish, warm spleen, stomach or Qi	温中/和中/补中	Relieve summer-heat	解暑/消暑	0.1541
Alcohols	醇类	Olefins	烯类	0.2552	Nourish, warm spleen, stomach or Qi	温中/和中/补中	Dispel endogenous cold	祛寒	0.1629
Alcohols	醇类	Repel foulness	辟秽	0.1206	Relieve pain	止痛	Clear away heat	清热	-0.1654
Alcohols	醇类	Regulate or enhance energy flow (Qi)	理气/养气	0.1169	Relieve pain	止痛	Detoxification	解毒	-0.1146
Alcohols	醇类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1196	Relieve pain	止痛	Dispel endogenous cold	祛寒	0.2166
Alcohols	醇类	Clear away heat	清热	-0.1557	Relieve pain	止痛	Dispel endogenous wind	祛风	0.1423
Enzymes	酶类	Strengthen and reinforce spleen	健脾/补脾	0.133	Clear away heat	清热	Eliminate dampness	利湿	0.2552
Enzymes	酶类	Relieve sore throat	利咽	0.1517	Clear away heat	清热	Detoxification	解毒	0.4939
Enzymes	酶类	Astringe intestine	涩肠	0.1479	Clear away heat	清热	Dispel endogenous cold	祛寒	-0.1798
Ketones or flavonoids	(黄)酮类	Alkanes or hydrocarbons	烷类/烃类	0.1265	Clear away heat	清热	Dispel endogenous damp	祛湿	-0.1267
Ketones or flavonoids	(黄)酮类	Olefins	烯类	0.1821	Clear away heat	清热	Dispel endogenous wind	祛风	-0.1138
Ketones or flavonoids	(黄)酮类	Triple burner	三焦	0.1022	Clear away heat	清热	Relieve rheumatism or lubricate the joints	祛风湿/利关节	-0.1259
Ketones or flavonoids	(黄)酮类	Regulate or enhance energy flow (Qi)	理气/养气	0.1136	Eliminate dampness	利湿	Detoxification	解毒	0.1492
Alkanes or hydrocarbons	烷类/烃类	Kidney meridians and collaterals	肾	0.1032	Eliminate dampness	利湿	Dispel endogenous damp	祛湿	-0.1239
Alkanes or hydrocarbons	烷类/烃类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.1291	Detoxification	解毒	Dispel endogenous cold	祛寒	-0.1536
Alkanes or hydrocarbons	烷类/烃类	Eliminate impediment	除痹	0.1121	Detoxification	解毒	Discharge pus, diminish inflammation or anti-infection	排脓/消炎/抗感染	0.1319
Ethers	醚类	Olefins	烯类	0.2113	Decrease internal heat	降火	Dry dampness	燥湿	0.2968
Ethers	醚类	Eliminate or relieve stuffy nose	通鼻窍	0.1446	Relieve summer-heat	解暑/消暑	Relieve external syndrome	解表/发表	0.2078
Ethers	醚类	Dispel endogenous cold	祛寒	0.1397	Dispel endogenous cold	祛寒	Dispel endogenous wind	祛风	0.1431
Ethers	醚类	Dispel endogenous wind	祛风	0.113	Dispel endogenous damp	祛湿	Dispel endogenous wind	祛风	0.433
Olefins	烯类	Spleen meridians and collaterals	脾	0.1563	Dispel endogenous damp	祛湿	Relieve itching	止痒	0.1082
Olefins	烯类	Large intestine meridians and collaterals	大肠	-0.1164	Dispel endogenous damp	祛湿	Kill or expel parasites	杀虫/驱虫	0.1044
Olefins	烯类	Whet the appetite or reinforce stomach	开胃/益胃	0.1875	Dry dampness	燥湿	Suppress perspiration	止汗	0.1216
Olefins	烯类	Prevent or arrest vomiting	止呕	0.1277	Dry dampness	燥湿	Kill or expel parasites	杀虫/驱虫	0.1063
Olefins	烯类	Regulate or enhance energy flow (Qi)	理气/养气	0.1907	Induce perspiration	发汗	Relieve external syndrome	解表/发表	0.1758
Olefins	烯类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.2133	Induce perspiration	发汗	Relieve muscular spasm	解痉	0.1948
Olefins	烯类	Clear away heat	清热	-0.1055	Relieve external syndrome	解表/发表	Relieve muscular spasm	解痉	0.1758
Olefins	烯类	Detoxification	解毒	-0.1085	Relieve external syndrome	解表/发表	Expose exanthema or promote eruption	透疹	0.3065
Olefins	烯类	Dispel endogenous cold	祛寒	0.2672	Relieve itching	止痒	Kill or expel parasites	杀虫/驱虫	0.2709
Olefins	烯类	Relieve external syndrome	解表/发表	0.1121					

n=772

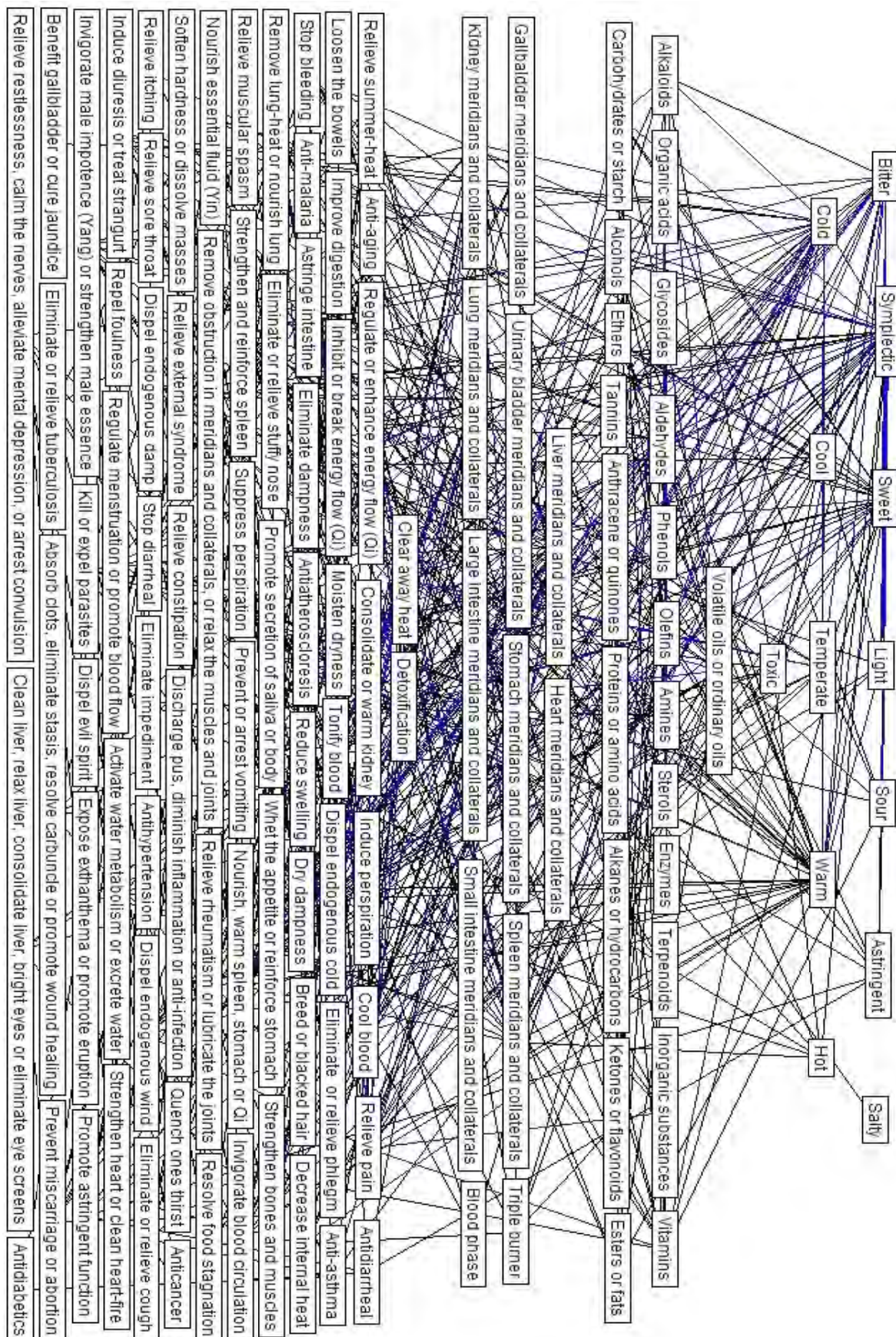


Fig. 1 Relational network for medicinal attributes and functions of Chinese herbal medicines (Zhang, 2012a). Black links represent positive point correlation and blue for negative point correlation. Isolated nodes are included.

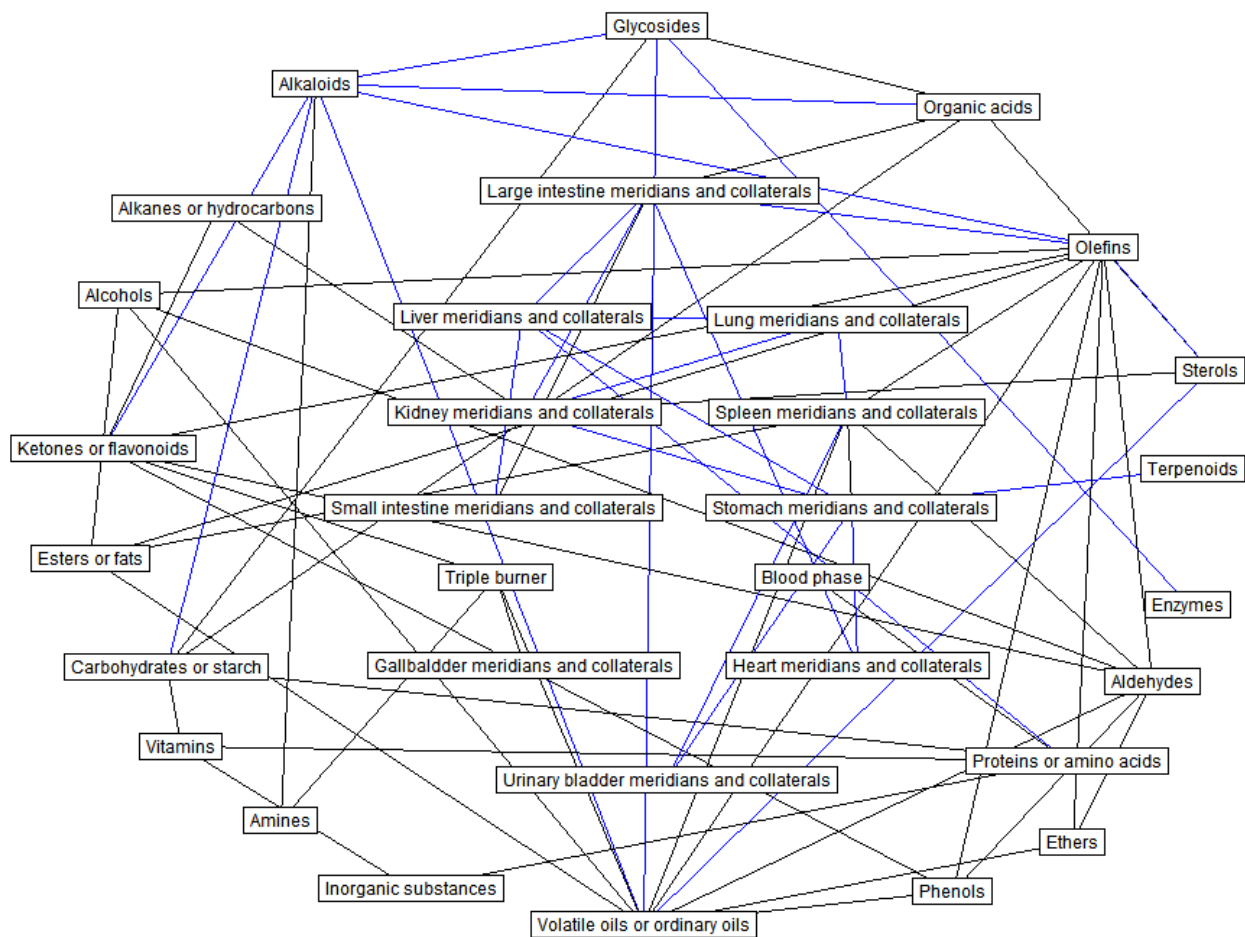


Fig. 2 Relational network for chemical composition categories and meridians and collaterals of Chinese herbal medicines (Zhang, 2012a). Black links represent positive point correlation and blue for negative point correlation. Isolated nodes are included.

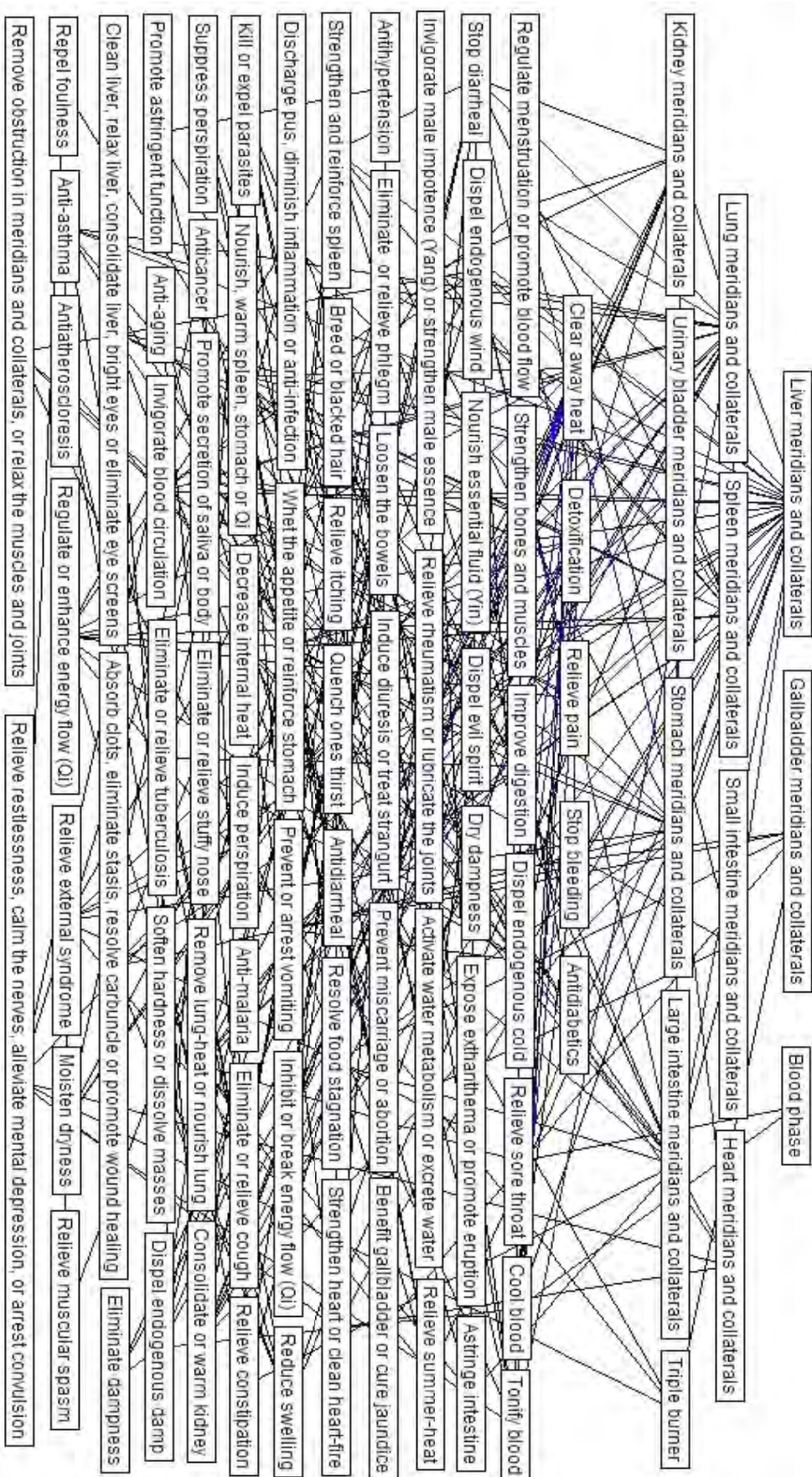


Fig. 3 Relational network for meridians and collaterals and medicinal functions of Chinese herbal medicines (Zhang, 2012a). Black links represent positive point correlation and blue for negative point correlation. Isolated nodes are included.

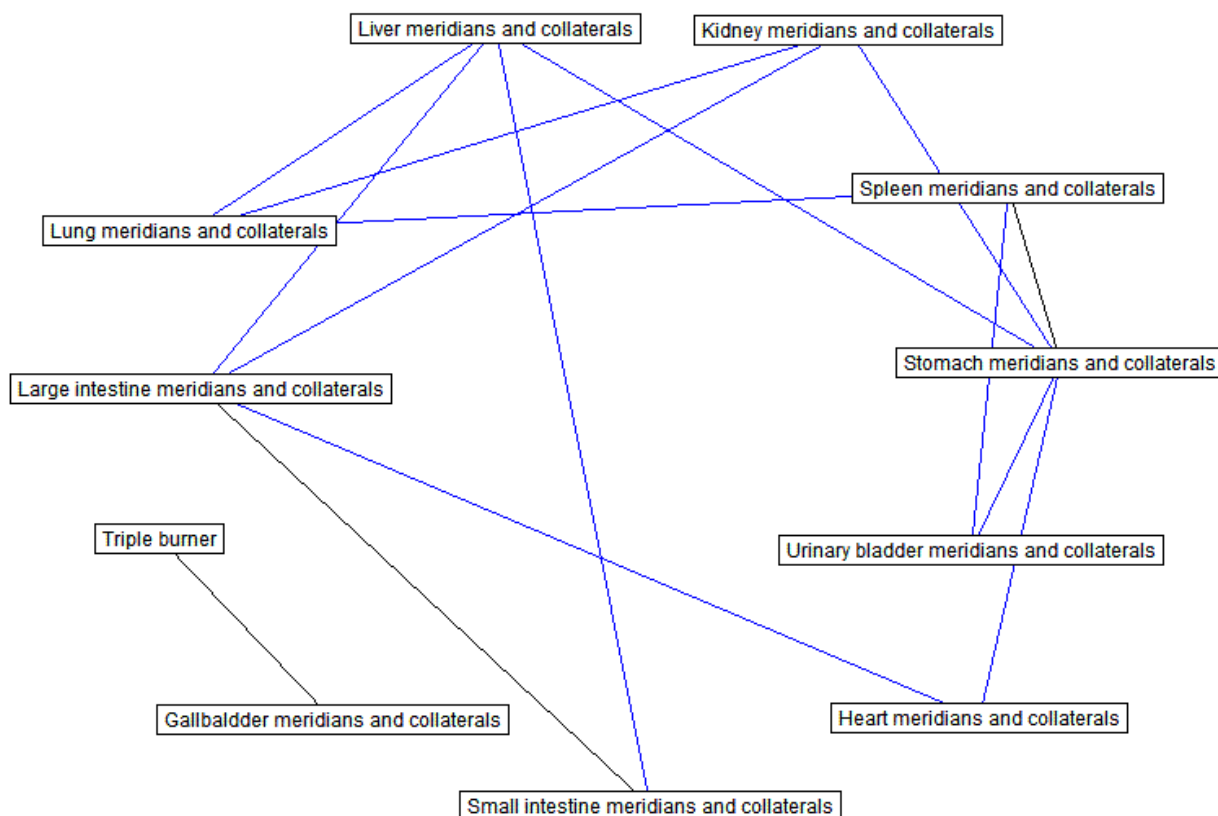


Fig. 4 Relational network for meridians and collaterals of Chinese herbal medicines (Zhang, 2012a). Black links represent positive point correlation and blue for negative point correlation. Isolated nodes are included.

3.2 Relationships among attributes and functions

3.2.1 Taste attributes

According to Table 1, bitter and cold, and bitter and toxicity have positive correlations respectively. That is, Bitter herbal medicines has the greater probability of toxic. Bitter and alkaloids have positive correlation / correspondence. Bitter herbal medicines usually contains more alkaloids. Bitter negatively correlates with proteins / amino acids, aldehydes, olefins, and vitamins. Bitter negatively correlates with spleen meridians and collaterals, i.e., bitter herbal medicines avoid to be used for spleen meridians and collaterals. Bitter herbal medicines mainly function in clear away heat, detoxification, decrease internal heat, but avoid to be used in consolidate or warm kidney, invigorate male impotence (Yang) / strengthen male essence, whet the appetite / reinforce stomach, strengthen and reinforce spleen, etc.

There are positive correlations between symplectic and warm, symplectic and heat, symplectic and toxicity, respectively. Symplectic herbal medicines have the greater probability of toxic. Symplectic and carbohydrates / starch have a negative correlation, i.e., the herbal medicines with less carbohydrates / starch tend to be symplectic. Symplectic positively correlates with volatile oils / ordinary oils, phenols, aldehydes, alcohols, and olefins. Symplectic positively correlate with spleen meridians and collaterals, and negatively correlative with large intestine meridians and collaterals. That is, symplectic herbal medicines avoid to be used for large intestine meridians and collaterals. Symplectic herbal medicines mainly function in regulate / enhance energy flow (Qi), eliminate / relieve phlegm, inhibit / break energy flow (Qi), nourish or warm spleen / stomach / Qi, relieve pain, dispel endogenous cold, dispel endogenous damp, dispel endogenous wind, relieve

external syndrome, etc., but avoid to be used in induce diuresis / treat strangurt, relieve constipation, loosen the bowels, cool blood, tonify blood, etc.

Sweet negatively correlate with toxicity, i.e., sweet herbal medicines are likely intoxic. Sweet and olefins have a negative correlation, and positively correlates with organic acids, sterols, proteins / amino acids, carbohydrates / starch, and vitamins. Sweet herbal medicines mainly act on spleen meridians and collaterals. Sweet herbal medicines mainly function in consolidate / warm kidney, induce diuresis / treat strangurt, invigorate male impotence (Yang) / strengthen male essence, remove lung-heat / nourish lung, strengthen and reinforce spleen, promote secretion of saliva / body, etc., but avoid to be used in relieve pain, dispel endogenous cold, dispel endogenous wind, dry dampness, etc.

Sour positively correlates with astringent. Sour have positive correlations with organic acids, and vitamins. More content of organic acids means the more sour taste in herbal medicines. Sour herbal medicines mainly function in promote secretion of saliva / body, astringe intestine, etc.

Astringent herbal medicines contain more tannins. Astringent herbal medicines mainly function in astringe intestine, antidiarrheal, stop diarrheal, stop bleeding, promote astringent function, etc.

Salty herbal medicines mainly function in soften hardness / dissolve masses.

3.2.2 Medicinal properties

Cold positively correlates with alkaloids. Cold herbal medicines usually contain more alkaloids. Cold herbal medicines mainly act on urinary bladder meridians and collaterals, and small intestine meridians and collaterals, but avoid to be used for acting on spleen and kidney meridians and collaterals. Cold herbal medicines mainly function in induce diuresis / treat strangurt, relieve constipation, soften hardness / dissolve masses, cool blood, clear away heat, detoxification, decrease internal heat, and avoid to be used in consolidate / warm kidney, whet the appetite / reinforce stomach, strengthen and reinforce spleen, relieve pain, regulate / enhance energy flow (Qi), nourish or warm spleen / stomach / Qi, dispel endogenous cold / wind/ damp, etc.

Cool herbal medicines mainly function in cool blood, clear away heat, detoxification, eliminate dampness, etc.

Warm herbal medicines usually contain more volatile oils / ordinary oils, aldehydes, esters / fats, alcohols, ethers, and olefins. They mainly act on spleen meridians and collaterals; mainly function in consolidate / warm kidney, invigorate male impotence (Yang) / strengthen male essence, strengthen bones and muscles, whet the appetite / reinforce stomach, regulate / enhance energy flow (Qi), inhibit / break energy flow (Qi), nourish or warm spleen / stomach / Qi, relieve pain, dispel endogenous cold / damp / wind, induce perspiration, etc., and avoid to be used in induce diuresis / treat strangurt, clear away heat, eliminate dampness, detoxification, decrease internal heat, etc.

Heat herbal medicines usually contain more amines, alkanes / hydrocarbons, and have the greater probability of toxic. Heat herbal medicines mainly act on spleen meridians and collaterals, and function in invigorate male impotence (Yang) / strengthen male essence, dispel endogenous cold, etc.

3.2.3 Toxicity

According to Table 1, the toxicity of Chinese herbal medicines usually arises from alkaloids. Toxic herbal medicines mainly function in reduce swelling, relieve pain, kill / expel parasites, anti-asthma, etc.

3.2.4 Chemical composition categories

According to Table 1, glycosides positively correlate to organic acids, and carbohydrates / starch. Most of the hydrolyzates of glycosides are organic acids, and carbohydrates / starch, etc. Glycosides negatively correlate with alkaloids, volatile oils / ordinary oils, and enzymes. Most of the glycosides may not beneficial to prevent / arrest vomiting, nourish or warm spleen / stomach / Qi, and relieve pain.

Organic acids and alkaloids have a negative correlation. More content of organic acids means the less

alkaloids. Organic acids positively correlate with sterols, and carbohydrates / starch. Organic acids mainly act on large intestine meridians and collaterals, and function in moisten dryness.

Alkaloids and amines have a positive correlation. More alkaloids prelude more amines in herbal medicines. Alkaloids negatively correlate with volatile oils / ordinary oils, carbohydrates / starch, ketones / flavonoids, and olefins. Alkaloids mainly function in decrease internal heat, dry dampness, etc., and at the level of $\alpha=0.01$, function in relieve pain also.

Amines mainly act on triple burner, and mainly function in eliminate impedimen.

Sterols negatively correlate with volatile oils / ordinary oils, and olefins, and mainly act on kidney meridians and collaterals.

Volatile oils / ordinary oils positively correlate with phenols, aldehydes, esters / fats, alcohols, ethers, and olefins, and mainly act on spleen meridians and collaterals, and triple burner. Volatile oils / ordinary oils mainly function in eliminate / relieve phlegm, eliminate / relieve stuffy nose, whet the appetite / reinforce stomach, improve digestion, regulate / enhance energy flow (Qi), nourish or warm spleen / stomach / Qi, and avoid to be used in stop bleeding, clear away heat, and detoxification.

Proteins / amino acids positively correlate with carbohydrates / starch, vitamins, and inorganic substances. They mainly act on blood phase and avoid to be used for acting on liver meridians and collaterals. Proteins / amino acids mainly function in remove lung-heat / nourish lung, strengthen and reinforce spleen, relieve sore throat, anti-aging, etc.

Terpenoids avoid to be used for acting on stomach meridians and collaterals, and function mainly in relieve itching, etc.

Phenols positively correlate with aldehydes, ketones / flavonoids, and olefins, which mainly function in stop bleeding, etc.

Aldehydes positively correlate with alcohols, ketones / flavonoids, ethers, and olefins, and mainly act on spleen meridians and collaterals. Aldehydes mainly function in eliminate / relieve phlegm, prevent / arrest vomiting, regulate / enhance energy flow (Qi), nourish or warm / spleen / stomach / Qi, dispel endogenous cold, etc., and avoid to be used in reduce swelling.

Esters / fats positively correlate with alcohols, and olefins. They mainly act on spleen meridians and collaterals, and mainly function in strengthen and reinforce spleen.

Carbohydrates / starch avoid to be used in relieve pain.

Alcohols and olefins have positive correlation. Alcohols mainly function in repel foulness, regulate / enhance energy flow (Qi), nourish or warm spleen / stomach / Qi, and avoid to be used in clear away heat.

Enzymes mainly function in strengthen and reinforce spleen, etc.

Ketones / flavonoids positively correlate with alkanes / hydrocarbons, and olefins. They mainly act on triple burner and function in eliminate impediment.

Ethers and olefins have a positive correlation, and they are usually the components of volatile oils. Ethers mainly function in eliminate / relieve stuffy nose, dispel endogenous cold, dispel endogenous wind.

Olefins mainly act on spleen meridians and collaterals and avoid to be used for acting on large intestine meridians and collaterals. Olefins mainly function in whet the appetite / reinforce stomach, prevent / arrest vomiting, regulate / enhance energy flow (Qi), nourish or warm spleen / stomach / Qi, dispel endogenous cold, relieve external syndrome, and avoid to be used in clear away heat, detoxification.

Anthracene / quinones mainly function in antihypertension.

Tannins mainly function in astringe intestine, stop bleeding, and promote astringent function.

Vitamins mainly function in promote secretion of saliva / body, antiatherosclerosis, anti-aging, quench ones thirst, and relieve summer-heat, etc.

3.2.5 Meridians / collaterals

Liver meridians and collaterals negatively correlates with lung, stomach, large intestine and small intestine meridians and collaterals. It positively functions in clean liver / relax liver / consolidate liver / bright eyes / eliminate eye screens, strengthen bones and muscles, cool blood, stop bleeding, invigorate blood circulation, absorb clots, eliminate stasis, resolve carbuncle / promote wound healing, regulate menstruation / promote blood flow, relieve pain, dispel endogenous wind, relieve rheumatism / lubricate the joints, and negatively functions in remove lung-heat / nourish lung, eliminate / relieve phlegm, anti-asthma, whet the appetite / reinforce stomach, strengthen and reinforce spleen, promote secretion of saliva / body, relieve sore throat, strengthen heart / clean heart-fire, etc.

Gallbladder meridians and collaterals positively correlates with triple burner, and positively functions in benefit gallbladder / cure jaundice, prevent / arrest vomiting, prevent miscarriage / abortion, dry dampness, etc.

Urinary bladder meridians and collaterals negatively correlates with spleen and stomach meridians and collaterals. Urinary bladder meridians and collaterals positively functions in induce diuresis / treat strangury, activate water metabolism / excrete water, and dispel evil spirit.

Kidney meridians and collaterals negatively correlates with lung, stomach and large intestine meridians and collaterals. It positively functions in consolidate / warm kidney, invigorate male impotence (Yang) / strengthen male essence, strengthen bones and muscles, stop diarrheal, regulate menstruation / promote blood flow, relieve rheumatism / lubricate the joints, and negatively functions in clear away heat, and detoxification.

Lung meridians and collaterals negatively correlates with spleen meridians and collaterals. It positively functions in remove lung-heat / nourish lung, eliminate / relieve phlegm, anti-asthma, eliminate / relieve cough, clear away heat, detoxification, relieve external syndrome, and negatively functions in consolidate / warm kidney, invigorate male impotence (Yang) / strengthen male essence, strengthen bones and muscles, stop diarrheal, tonify blood, invigorate blood circulation, absorb clots, eliminate stasis, resolve carbuncle / promote wound healing, regulate menstruation / promote blood flow, and dispel endogenous damp.

Spleen meridians and collaterals positively correlates with stomach meridians and collaterals. It positively functions in invigorate male impotence (Yang) / strengthen male essence, whet the appetite / reinforce stomach, strengthen and reinforce spleen, improve digestion, prevent / arrest vomiting, stop diarrheal, regulate / enhance energy flow (Qi), nourish or warm spleen / stomach / Qi, dispel endogenous cold, and negatively functions in clear away heat, and detoxification.

Stomach meridians and collaterals negatively correlates with heart meridians and collaterals, and positively functions in whet the appetite / reinforce stomach, strengthen and reinforce spleen, improve digestion, promote secretion of saliva / body, resolve food stagnation, prevent / arrest vomiting, nourish or warm spleen / stomach / Qi, relieve summer-heat, relieve external syndrome, and negatively functions in consolidate / warm kidney, regulate menstruation / promote blood flow.

Heart meridians and collaterals negatively correlates with large intestine meridians and collaterals. It positively functions in strengthen heart / clean heart-fire, relieve restlessness / calm the nerves / alleviate mental depression / arrest convulsion, and negatively functions in clean liver / relax liver / consolidate liver / bright eyes / eliminate eye screens.

Large intestine meridians and collaterals positively correlates with small intestine meridians and collaterals. It positively functions in resolve food stagnation, relieve constipation, loosen the bowels, astringe intestine, antidiarrheal, decrease internal heat, dry dampness, kill / expel parasites, induce diuresis / treat strangury, activate water metabolism / excrete water, clear away heat, and negatively functions in invigorate blood circulation, dispel endogenous wind.

Blood phase positively functions in relieve sore throat, and cool blood.

Triple burner positively functions in relieve restlessness / calm the nerves / alleviate mental depression / arrest convulsion, regulate / enhance energy flow (Qi), and decrease internal heat.

3.2.6 Medicinal functions

Between-function relationships can be found in Table 1 and Appendices.

3.3 Multiple attributes chain

In present study, the length of a multiple attributes chain represents the depth of influence of correlations between attribute classes. The multiple attributes chains are listed in Appendix 2. In a multiple attributes chain, there are not identical positive or identical negative between-attribute correlations. For example, in the chain bitter-cold-volatile oils / ordinary oils-stop bleeding, bitter-cold is a positive correlation, but cold-volatile oils / ordinary oils is a negative correlation, etc.

4 Discussion

Some of the aforementioned pharmacological results have been applied in practice. For example, cannabis and poppy contain richful alkaloids, and thus commonly used to decrease internal heat, relieve pain, etc. Medicinal plants with richful alkaloids, such as tea, can decrease internal heat, dry dampness, etc. Most fruits are rich in organic acids, which help moisten dryness. Toxic herbal medicines are mainly used in reduce swelling, relieve pain, kill or expel parasites. Cool herbal medicines are mainly used in cool blood, clear away heat, and detoxification.

Chinese herbal compounds are usually used for multiple meridians / collaterals and multiple targets, which leads to a pharmacological network. The present results also show that the pharmacological system of Chinese herbal medicines has a complex network structure. It supports the theory of network view, system concept and entirety view of Traditional Chinese Medicine.

The human body is a self-organizing system, in the normal range it can self-organize to adjust their functions without external intervention (Zhang, 2013, 2016d). In a sense, the network of meridians and collaterals and the network of meridians and collaterals and medicinal functions are self-organizing systems. Theoretically, the dynamics behavior of these networks can be simulated by using network evolution models (Zhang, 2015a, 2016f; Haliki and Kazanci, 2017).

It is expected that the results of the present study help to guide the application of Chinese herbal medicines, improve drug development, and revise or enhance the theory of Chinese herbal medicines. On the other hand, in this study the medicinal functions, especially the chemical composition categories, are just the framework definition. For example, the role of a chemical composition category is only a total result of all chemicals. In fact, different molecules may play somewhat different, even opposite roles in medicines even if they belong to the same category. In addition, in theory, the network of meridians and collaterals should be connected. At a relatively relaxed level of statistics, the foregoing results may be consistent with this rule.

There are many methods for network analysis of pharmacological analysis, e.g., centrality measures, etc (Zhang, 2016c). More contents on network analysis are expected to be implemented in the future.

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Appendix 1 Pairwise attributes and point correlation with statistic significance ($\alpha=0.01$) (only the contents different from Table 1 are listed here)

Attribute	属性	Attribute	属性	r	Attribute	属性	Attribute	属性	r
Bitter	苦	Carbohydrates or starch	糖类/淀粉	-0.0969	Aldehydes	醛类	Esters or fats	酯类/脂肪	0.0981
Bitter	苦	Enzymes	酶类	-0.0939	Aldehydes	醛类	Repel foulness	辟秽	0.0939
Bitter	苦	Liver meridians and collaterals	肝	0.1009	Aldehydes	醛类	Relieve muscular spasm	解痉	0.0939
Bitter	苦	Repel foulness	辟秽	-0.0965	Esters or fats	酯类/脂肪	Clear away heat	清热	-0.0956
Bitter	苦	Dry dampness	燥湿	0.1002	Esters or fats	酯类/脂肪	Dispel endogenous cold	祛寒	0.097
Symplectic	辛	Vitamins	维生素类	-0.0945	Carbohydrates or starch	糖类/淀粉	Consolidate or warm kidney	补肾/温肾	0.1007
Symplectic	辛	Repel foulness	辟秽	0.098	Alcohols	醇类	Ketones or flavonoids	(黄)酮类	0.1007
Symplectic	辛	Antidiarrheal	止痢	-0.099	Alcohols	醇类	Triple burner	三焦	0.0933
Symplectic	辛	Reduce swelling	消肿	0.0927	Alcohols	醇类	Antihypertension	降压	0.1003
Symplectic	辛	Induce perspiration	发汗	0.098	Enzymes	酶类	Eliminate impediment	除痹	0.0961
Symplectic	辛	Relieve itching	止痒	0.0983	Olefins	烯类	Stomach meridians and collaterals	胃	0.1006
Sweet	甘	Sour	酸	0.0935	Olefins	烯类	Repel foulness	辟秽	0.0978
Sweet	甘	Alkaloids	生物碱类	-0.0939	Anthracene or quinones	蒽类/醌类	Eliminate dampness	利湿	0.0952
Sweet	甘	Inorganic substances	无机物	0.0935	Anthracene or quinones	蒽类/醌类	Promote astringent function	收敛	0.0982
Sweet	甘	Relieve constipation	通便	0.0927	Tannins	鞣质类	Antidiabetics	降糖	0.0948
Light	淡	Reduce swelling	消肿	0.0929	Vitamins	维生素类	Consolidate or warm kidney	补肾/温肾	0.0952
Sour	酸	Tannins	鞣质类	0.0943	Vitamins	维生素类	Loosen the bowels	润肠	0.0989
Sour	酸	Stop diarrheal	止泻	0.0946	Liver meridians and collaterals	肝	Activate water metabolism or excrete water	利水/行水	-0.0981
Astringent	涩	Temperate	平	0.094	Liver meridians and collaterals	肝	Stop diarrheal	止泻	-0.0963
Astringent	涩	Enzymes	酶类	0.0972	Urinary bladder meridians and collaterals	膀胱	Induce perspiration	发汗	0.095
Astringent	涩	Regulate or enhance energy flow (Qi)	理气/养气	-0.1005	Kidney meridians and collaterals	肾	Tonify blood	养血/补血	0.0955
Cold	寒	Glycosides	甙类	0.0948	Kidney meridians and collaterals	肾	Prevent miscarriage or abortion	安胎	0.0933
Cold	寒	Benefit gallbladder or cure jaundice	利胆/退黄	0.0985	Lung meridians and collaterals	肺	Relieve sore throat	利咽	0.0957
Cold	寒	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	-0.0932	Spleen meridians and collaterals	脾	Dry dampness	燥湿	0.0944
Cold	寒	Nourish essential fluid (Yin)	滋阴	0.0996	Stomach meridians and collaterals	胃	Invigorate blood circulation	活血	-0.1003
Cold	寒	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	-0.095	Stomach meridians and collaterals	胃	Regulate or enhance energy flow (Qi)	理气/养气	0.0954
Cool	凉	Stop bleeding	止血	0.0965	Stomach meridians and collaterals	胃	Dispel endogenous wind	祛风	-0.0987
Cool	凉	Relieve pain	止痛	-0.0932	Heart meridians and collaterals	心	Clear away heat	清热	0.0985
Temperate	平	Toxic	毒	-0.094	Large intestine meridians and collaterals	大肠	Inhibit or break energy flow (Qi)	下气/破气	0.099
Warm	温	Repel foulness	辟秽	0.0966	Large intestine meridians and collaterals	大肠	Detoxification	解毒	0.0998
Warm	温	Prevent or arrest vomiting	止呕	0.0994	Triple burner	三焦	Improve digestion	消食/化食	0.0952
Warm	温	Relieve muscular spasm	解痉	0.0966	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens	清肝/补肝/舒肝/明目/退翳	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	0.0993
Hot	热	Alkaloids	生物碱类	0.0997	Induce diuresis or treat strangury	利尿/通淋	Dispel endogenous wind	祛风	-0.0958
Hot	热	Dispel endogenous damp	祛湿	0.093	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	Reduce swelling	消肿	-0.0942
Toxic	毒	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化瘀/消痈/敛疮	0.0993	Invigorate male impotence (Yang) or strengthen male essence	壮阳/温阳/益精	Relieve pain	止痛	-0.093
Glycosides	甙类	Stop diarrheal	止泻	-0.1001	Strengthen bones and muscles	强筋骨	Invigorate blood circulation	活血	0.0966

Glycosides	甙类	Cool blood	凉血	0.0989	Promote granulation	生肌	Discharge pus, diminish inflammation or anti-infection	排脓/消炎/抗感染	0.0933
Glycosides	甙类	Stop bleeding	止血	0.0966	Remove lung-heat or nourish lung	清肺/润肺	Invigorate blood circulation	活血	-0.0965
Organic acids	有机酸类	Esters or fats	酯类/脂肪	0.0958	Eliminate or relieve phlegm	祛痰/化痰	Invigorate blood circulation	活血	-0.0974
Organic acids	有机酸类	Relieve constipation	通便	0.0961	Eliminate or relieve phlegm	祛痰/化痰	Anti-aging	抗衰老	0.0961
Organic acids	有机酸类	Loosen the bowels	润肠	0.0984	Anti-asthma	平喘/定喘	Clear away heat	清热	-0.0963
Alkaloids	生物碱类	Aldehydes	醛类	-0.0971	Whet the appetite or reinforce stomach	开胃/益胃	Prevent or arrest vomiting	止呕	0.0956
Alkaloids	生物碱类	Alcohols	醇类	-0.0991	Promote secretion of saliva or body	生津	Reduce swelling	消肿	-0.0938
Alkaloids	生物碱类	Regulate or enhance energy flow (Qi)	理气/养气	-0.0978	Promote secretion of saliva or body	生津	Dispel endogenous wind	祛风	-0.0946
Alkaloids	生物碱类	Relieve pain	止痛	0.098	Relieve sore throat	利咽	Detoxification	解毒	0.0981
Amines	胺类	Nourish, warm spleen, stomach or Qi	温中/和中/补中	0.0981	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	除烦/安神/解郁/定惊	Regulate or enhance energy flow (Qi)	理气/养气	0.0967
Volatile oils or ordinary oils	挥发油类/油类	Carbohydrates or starch	糖类/淀粉	-0.093	Relieve constipation	通便	Dispel endogenous wind	祛风	-0.0929
Volatile oils or ordinary oils	挥发油类/油类	Liver meridians and collaterals	肝	-0.0967	Stop diarrheal	止泻	Eliminate impediment	除痹	0.0935
Volatile oils or ordinary oils	挥发油类/油类	Eliminate impediment	除痹	0.0971	Stop bleeding	止血	Regulate or enhance energy flow (Qi)	理气/养气	-0.0929
Proteins or amino acids	蛋白质/氨基酸类	Stop diarrheal	止泻	0.0946	Invigorate blood circulation	活血	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化瘀/消痈/敛疮	0.0957
Proteins or amino acids	蛋白质/氨基酸类	Relieve muscular spasm	解痉	0.0995	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	化瘀/消痈/敛疮	Nourish, warm spleen, stomach or Qi	温中/和中/补中	-0.0932
Phenols	酚类	Ethers	醚类	0.1004	Remove obstruction in meridians and collaterals, or relax the muscles and joints	通络/活络/舒筋	Clear away heat	清热	-0.0966
Phenols	酚类	Tannins	鞣质类	0.0983					

n=772

Appendix 2 Multiple attributes chain (in part)

Attribute	Attribute	Attribute	Attribute	Attribute	Attribute	Attribute	Attribute	Attribute
Bitter	Cold	Volatile oils or ordinary oils	Stop bleeding		Light	Warm	Dispel endogenous cold	
Bitter	Cold	Urinary bladder meridians and collaterals	Dispel evil spirit		Light	Warm	Dispel endogenous damp	
Bitter	Cold	Induce diuresis or treat strangury			Light	Warm	Dispel endogenous wind	
Bitter	Cold	Strengthen bones and muscles			Light	Warm	Induce perspiration	
Bitter	Cold	Relieve constipation			Light	Sterols	Kidney meridians and collaterals	Stop diarrheal
Bitter	Cold	Soften hardness or dissolve masses			Light	Sterols	Kidney meridians and collaterals	Regulate menstruation or promote blood flow
Bitter	Cold	Cool blood			Light	Sterols	Kidney meridians and collaterals	Relieve rheumatism or lubricate the joints
Bitter	Cold	Invigorate blood circulation			Light	Small intestine meridians and collaterals	Activate water metabolism or excrete water	
Bitter	Cold	Regulate or enhance energy flow (Qi)			Sour	Temperate	Warm	Eliminate or relieve stuffy nose
Bitter	Cold	Relieve pain			Sour	Temperate	Warm	Induce perspiration
Bitter	Cold	Dispel endogenous damp			Sour	Temperate	Toxic	Reduce swelling

Bitter	Cold	Dispel endogenous wind		Sour	Temperate	Olefins	Prevent or arrest vomiting
Bitter	Temperate	Relieve rheumatism or lubricate the joints		Sour	Temperate	Olefins	Regulate or enhance energy flow (Qi)
Bitter	Warm	Alcohols	Repel foulness	Sour	Temperate	Olefins	Relieve external syndrome
Bitter	Warm	Eliminate or relieve stuffy nose		Sour	Temperate	Urinary bladder meridians and collaterals	Activate water metabolism or excrete water
Bitter	Warm	Improve digestion		Sour	Temperate	Urinary bladder meridians and collaterals	Dispel evil spirit
Bitter	Warm	Inhibit or break energy flow (Qi)		Sour	Temperate	Strengthen and reinforce spleen	
Bitter	Warm	Eliminate dampness		Sour	Temperate	Cool blood	
Bitter	Warm	Induce perspiration		Sour	Temperate	Invigorate blood circulation	
Bitter	Toxic	Activate water metabolism or excrete water		Sour	Temperate	Clear away heat	
Bitter	Toxic	Anti-asthma		Sour	Temperate	Dispel endogenous cold	
Bitter	Toxic	Reduce swelling		Sour	Temperate	Relieve rheumatism or lubricate the joints	
Bitter	Toxic	Kill or expel parasites		Sour	Organic acids	Large intestine meridians and collaterals	Resolve food stagnation
Bitter	Alkaloids	Dry dampness		Sour	Organic acids	Large intestine meridians and collaterals	Relieve constipation
Bitter	Proteins or amino acids	Liver meridians and collaterals	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens	Sour	Organic acids	Large intestine meridians and collaterals	Antidiarrheal
Bitter	Proteins or amino acids	Liver meridians and collaterals	Strengthen heart or clean heart-fire	Sour	Organic acids	Moisten dryness	
Bitter	Proteins or amino acids	Liver meridians and collaterals	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	Sour	Organic acids	Dry dampness	
Bitter	Proteins or amino acids	Liver meridians and collaterals	Regulate menstruation or promote blood flow	Sour	Vitamins	Antiatherosclerosis	
Bitter	Proteins or amino acids	Remove lung-heat or nourish lung		Sour	Vitamins	Anti-aging	
Bitter	Proteins or amino acids	Relieve sore throat		Sour	Vitamins	Relieve pain	
Bitter	Proteins or amino acids	Anti-aging		Sour	Vitamins	Quench ones thirst	
Bitter	Aldehydes	Eliminate or relieve phlegm		Sour	Vitamins	Relieve summer-heat	
Bitter	Aldehydes	Prevent or arrest vomiting		Cold	Alkaloids	Dry dampness	
Bitter	Olefins	Large intestine meridians and collaterals	Resolve food stagnation	Cold	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion
Bitter	Olefins	Large intestine meridians and collaterals	Antidiarrheal	Cold	Volatile oils or ordinary oils	Eliminate or relieve stuffy nose	
Bitter	Olefins	Relieve external syndrome		Cold	Volatile oils or ordinary oils	Improve digestion	
Bitter	Vitamins	Promote secretion of saliva or body		Cold	Volatile oils or ordinary oils	Stop bleeding	
Bitter	Vitamins	Antiatherosclerosis		Cold	Volatile oils or ordinary oils	Induce perspiration	
Bitter	Vitamins	Quench ones thirst		Cold	Olefins	Prevent or arrest vomiting	
Bitter	Vitamins	Relieve summer-heat		Cold	Urinary bladder meridians and collaterals	Activate water metabolism or excrete water	
Bitter	Spleen meridians and collaterals	Stop diarrheal		Cold	Urinary bladder meridians and collaterals	Dispel evil spirit	

Symplectic	Cold	Urinary bladder meridians and collaterals	Dispel evil spirit	Cold	Kidney meridians and collaterals	Stop diarrheal	
Symplectic	Cold	Kidney meridians and collaterals	Regulate menstruation or promote blood flow	Cold	Kidney meridians and collaterals	Regulate menstruation or promote blood flow	
Symplectic	Cold	Consolidate or warm kidney		Cold	Kidney meridians and collaterals	Relieve rheumatism or lubricate the joints	
Symplectic	Cold	Strengthen bones and muscles		Temperate	Olefins	Large intestine meridians and collaterals	Resolve food stagnation
Symplectic	Cold	Whet the appetite or reinforce stomach		Temperate	Olefins	Large intestine meridians and collaterals	Antidiarrheal
Symplectic	Cold	Strengthen and reinforce spleen		Temperate	Olefins	Prevent or arrest vomiting	
Symplectic	Cold	Soften hardness or dissolve masses		Temperate	Olefins	Regulate or enhance energy flow (Qi)	
Symplectic	Cold	Invigorate blood circulation		Temperate	Olefins	Relieve external syndrome	
Symplectic	Warm	Invigorate male impotence (Yang) or strengthen male essence		Temperate	Urinary bladder meridians and collaterals	Activate water metabolism or excrete water	
Symplectic	Warm	Eliminate or relieve stuffy nose		Temperate	Urinary bladder meridians and collaterals	Dispel evil spirit	
Symplectic	Warm	Improve digestion		Warm	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion
Symplectic	Warm	Induce perspiration		Warm	Volatile oils or ordinary oils	Stop bleeding	
Symplectic	Hot	Amines	Eliminate impediment	Warm	Aldehydes	Prevent or arrest vomiting	
Symplectic	Toxic	Activate water metabolism or excrete water		Warm	Aldehydes	Reduce swelling	
Symplectic	Toxic	Anti-asthma		Warm	Alcohols	Repel foulness	
Symplectic	Toxic	Reduce swelling		Warm	Spleen meridians and collaterals	Stop diarrheal	
Symplectic	Toxic	Kill or expel parasites		Hot	Toxic	Proteins or amino acids	Relieve sore throat
Symplectic	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	Hot	Toxic	Proteins or amino acids	Anti-aging
Symplectic	Volatile oils or ordinary oils	Stop bleeding		Hot	Toxic	Vitamins	Antiatherosclerosis
Symplectic	Aldehydes	Prevent or arrest vomiting		Hot	Toxic	Vitamins	Quench ones thirst
Symplectic	Alcohols	Repel foulness		Hot	Toxic	Vitamins	Relieve summer-heat
Symplectic	Spleen meridians and collaterals	Stop diarrheal		Hot	Toxic	Activate water metabolism or excrete water	
Symplectic	Large intestine meridians and collaterals	Resolve food stagnation		Hot	Toxic	Anti-asthma	
Symplectic	Large intestine meridians and collaterals	Astringe intestine		Hot	Toxic	Soften hardness or dissolve masses	
Symplectic	Large intestine meridians and collaterals	Antidiarrheal		Hot	Toxic	Reduce swelling	
Symplectic	Large intestine meridians	Dry dampness		Hot	Toxic	Kill or expel parasites	

		and collaterals						
Sweet	Temperate	Urinary bladder meridians and collaterals	Dispel evil spirit		Hot	Amines	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion
Sweet	Temperate	Cool blood			Hot	Amines	Eliminate impediment	
Sweet	Temperate	Invigorate blood circulation			Hot	Alkanes or hydrocarbons	Kidney meridians and collaterals	Regulate menstruation or promote blood flow
Sweet	Temperate	Clear away heat			Hot	Alkanes or hydrocarbons	Kidney meridians and collaterals	Relieve rheumatism or lubricate the joints
Sweet	Temperate	Relieve rheumatism or lubricate the joints			Hot	Spleen meridians and collaterals	Whet the appetite or reinforce stomach	
Sweet	Warm	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	Hot	Spleen meridians and collaterals	Strengthen and reinforce spleen	
Sweet	Warm	Volatile oils or ordinary oils	Stop bleeding		Hot	Spleen meridians and collaterals	Improve digestion	
Sweet	Warm	Alcohols	Repel foulness		Hot	Spleen meridians and collaterals	Prevent or arrest vomiting	
Sweet	Warm	Strengthen bones and muscles			Hot	Spleen meridians and collaterals	Stop diarrheal	
Sweet	Warm	Eliminate or relieve stuffy nose			Organic acids	Large intestine meridians and collaterals	Resolve food stagnation	
Sweet	Warm	Whet the appetite or reinforce stomach			Organic acids	Large intestine meridians and collaterals	Relieve constipation	
Sweet	Warm	Improve digestion			Organic acids	Large intestine meridians and collaterals	Antidiarrheal	
Sweet	Warm	Regulate or enhance energy flow (Qi)			Organic acids	Large intestine meridians and collaterals	Invigorate blood circulation	
Sweet	Warm	Inhibit or break energy flow (Qi)			Organic acids	Large intestine meridians and collaterals	Decrease internal heat	
Sweet	Warm	Nourish, warm spleen, stomach or Qi			Amines	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	
Sweet	Warm	Eliminate dampness			Amines	Triple burner	Regulate or enhance energy flow (Qi)	
Sweet	Warm	Detoxification			Amines	Triple burner	Decrease internal heat	
Sweet	Warm	Decrease internal heat			Sterols	Kidney meridians and collaterals	Strengthen bones and muscles	
Sweet	Warm	Dispel endogenous damp			Sterols	Kidney meridians and collaterals	Stop diarrheal	
Sweet	Warm	Induce perspiration			Sterols	Kidney meridians and collaterals	Regulate menstruation or promote blood flow	
Sweet	Toxic	Activate water metabolism or excrete water			Sterols	Kidney meridians and collaterals	Clear away heat	
Sweet	Toxic	Anti-asthma			Sterols	Kidney meridians and collaterals	Detoxification	

Sweet	Toxic	Soften hardness or dissolve masses		Sterols	Kidney meridians and collaterals	Relieve rheumatism or lubricate the joints
Sweet	Toxic	Reduce swelling		Volatile oils or ordinary oils	Spleen meridians and collaterals	Prevent or arrest vomiting
Sweet	Organic acids	Large intestine meridians and collaterals	Resolve food stagnation	Volatile oils or ordinary oils	Spleen meridians and collaterals	Stop diarrhea
Sweet	Organic acids	Large intestine meridians and collaterals	Antidiarrheal	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion
Sweet	Proteins or amino acids	Liver meridians and collaterals	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens	Proteins or amino acids	Liver meridians and collaterals	Clean liver, relax liver, consolidate liver, bright eyes or eliminate eye screens
Sweet	Proteins or amino acids	Liver meridians and collaterals	Strengthen heart or clean heart-fire	Proteins or amino acids	Liver meridians and collaterals	Strengthen bones and muscles
Sweet	Proteins or amino acids	Liver meridians and collaterals	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing	Proteins or amino acids	Liver meridians and collaterals	Eliminate or relieve phlegm
Sweet	Proteins or amino acids	Relieve sore throat		Proteins or amino acids	Liver meridians and collaterals	Anti-asthma
Sweet	Proteins or amino acids	Anti-aging		Proteins or amino acids	Liver meridians and collaterals	Strengthen heart or clean heart-fire
Sweet	Olefins	Prevent or arrest vomiting		Proteins or amino acids	Liver meridians and collaterals	Cool blood
Sweet	Olefins	Relieve external syndrome		Proteins or amino acids	Liver meridians and collaterals	Stop bleeding
Sweet	Vitamins	Antiatherosclerosis		Proteins or amino acids	Liver meridians and collaterals	Invigorate blood circulation
Sweet	Vitamins	Quench ones thirst		Proteins or amino acids	Liver meridians and collaterals	Absorb clots, eliminate stasis, resolve carbuncle or promote wound healing
Sweet	Vitamins	Relieve summer-heat		Proteins or amino acids	Liver meridians and collaterals	Regulate menstruation or promote blood flow
Sweet	Kidney meridians and collaterals	Stop diarrhea		Proteins or amino acids	Liver meridians and collaterals	Inhibit or break energy flow (Qi)
Sweet	Kidney meridians and collaterals	Regulate menstruation or promote blood flow		Proteins or amino acids	Liver meridians and collaterals	Relieve rheumatism or lubricate the joints
Light	Cool	Toxic	Anti-asthma	Proteins or amino acids	Liver meridians and collaterals	Relieve external syndrome
Light	Cool	Large intestine meridians and collaterals	Resolve food stagnation	Terpenoids	Stomach meridians and collaterals	Consolidate or warm kidney
Light	Cool	Large intestine meridians and collaterals	Astringe intestine	Terpenoids	Stomach meridians and collaterals	Whet the appetite or reinforce stomach
Light	Cool	Large intestine meridians and collaterals	Antidiarrheal	Terpenoids	Stomach meridians and collaterals	Strengthen and reinforce spleen
Light	Cool	Cool blood		Terpenoids	Stomach meridians and collaterals	Improve digestion
Light	Cool	Clear away heat		Terpenoids	Stomach meridians and collaterals	Promote secretion of saliva or body
Light	Cool	Detoxification		Terpenoids	Stomach meridians and collaterals	Resolve food stagnation

Light	Warm	Volatile oils or ordinary oils	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion	Terpenoids	Stomach meridians and collaterals	Prevent or arrest vomiting
Light	Warm	Volatile oils or ordinary oils	Stop bleeding		Terpenoids	Stomach meridians and collaterals	Regulate menstruation or promote blood flow
Light	Warm	Proteins or amino acids	Relieve sore throat		Terpenoids	Stomach meridians and collaterals	Nourish, warm spleen, stomach or Qi
Light	Warm	Proteins or amino acids	Anti-aging		Terpenoids	Stomach meridians and collaterals	Relieve summer-heat
Light	Warm	Aldehydes	Prevent or arrest vomiting		Terpenoids	Stomach meridians and collaterals	Relieve external syndrome
Light	Warm	Aldehydes	Reduce swelling		Aldehydes	Spleen meridians and collaterals	Stop diarrheal
Light	Warm	Alcohols	Repel foulness		Esters or fats	Spleen meridians and collaterals	Prevent or arrest vomiting
Light	Warm	Vitamins	Antiatherosclerosis		Esters or fats	Spleen meridians and collaterals	Stop diarrheal
Light	Warm	Vitamins	Quench ones thirst		Ketones or flavonoids	Triple burner	Relieve restlessness, calm the nerves, alleviate mental depression, or arrest convulsion
Light	Warm	Vitamins	Relieve summer-heat		Ketones or flavonoids	Triple burner	Decrease internal heat
Light	Warm	Consolidate or warm kidney			Alkanes or hydrocarbons	Kidney meridians and collaterals	Consolidate or warm kidney
Light	Warm	Induce diuresis or treat strangury			Alkanes or hydrocarbons	Kidney meridians and collaterals	Strengthen bones and muscles
Light	Warm	Invigorate male impotence (Yang) or strengthen male essence			Alkanes or hydrocarbons	Kidney meridians and collaterals	Stop diarrheal
Light	Warm	Strengthen bones and muscles			Alkanes or hydrocarbons	Kidney meridians and collaterals	Regulate menstruation or promote blood flow
Light	Warm	Eliminate or relieve stuffy nose			Alkanes or hydrocarbons	Kidney meridians and collaterals	Clear away heat
Light	Warm	Whet the appetite or reinforce stomach			Alkanes or hydrocarbons	Kidney meridians and collaterals	Detoxification
Light	Warm	Improve digestion			Alkanes or hydrocarbons	Kidney meridians and collaterals	Relieve rheumatism or lubricate the joints
Light	Warm	Regulate or enhance energy flow (Qi)			Olefins	Spleen meridians and collaterals	Stop diarrheal
Light	Warm	Inhibit or break energy flow (Qi)			Olefins	Large intestine meridians and collaterals	Resolve food stagnation
Light	Warm	Nourish, warm spleen, stomach or Qi			Olefins	Large intestine meridians and collaterals	Astringe intestine
Light	Warm	Relieve pain			Olefins	Large intestine meridians and collaterals	Antidiarrheal
Light	Warm	Decrease internal heat					