Can traditional Chinese medicine be used for prevention of Corona virus disease (COVID-19)? A review of historical classics, research evidence and current prevention programs

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**Abstract:**

Objective: Since December 2019, an outbreak of pneumonia associated with the corona virus disease 2019 (COVID-19) occurred in Wuhan, and rapidly spread to all parts of China. This was followed by prevention programs announcing traditional Chinese medicine (TCM) recommendations for its prevention. In order to provide evidence for these TCM recommendations, we reviewed ancient classics and human studies.

Methods: Historical records on prevention and treatment of infections in TCM classics, clinical evidence of TCM on the prevention of severe acute respiratory syndrome (SARS) and H1N1 influenza, and TCM prevention programs issued by health authorities in China since the COVID-19 outbreak were retrieved from different databases and websites till 11 Feb. 2020. Research evidence included data from clinical trials, cohort, and population studies using TCM for preventing contagious respiratory virus diseases.

Results: The use of TCM to prevent epidemics of infectious diseases was traced back to ancient Chinese practice cited in the *Huangdi Internal Classic,* where preventive effects were recorded. There were three studies using TCM for prevention of SARS and four studies for H1N1 influenza. None of the participants who took Chinese medicine contracted SARS in the three studies. The infection rate of H1N1 influenza in the TCM group was significantly lower than non-TCM group (RR 0.36, 95% CI 0.24-0.52; n=4). For prevention of COVID-19, 23 provinces in China issued TCM programs. The main principles of TCM use were to tonify qi to protect from external pathogens, disperse wind and discharge heat, and resolve dampness . The most frequently used herbs included *Astragali* (Huangqi), *Glycyrrhizae* (Gancao), *Saposhnikoviae* (Fangfeng), *Atractylodis Macrocephalae* (Baizhu), *Lonicerae Japonicae* (Jinyinhua), and *Forsythiae* (Lianqiao).

Conclusions: Based on historical records and human evidence of SARS and H1N1 influenza prevention, Chinese herbal formula could be an alternative approach for prevention of COVID-19 in high-risk population. Prospective, rigorous population studies are warranted to confirm the potential preventive effect of Chinese medicine.

# Keywords: traditional Chinese medicine; 2019 novel coronavirus; prevention program; clinical evidence; review. COVID-19

**Introduction**

In December 2019, a pneumonia associated with the 2019 novel coronavirus (COVID-19) emerged in Wuhan, Hubei province, China.(1) It is highly contagious and has quickly spread to other parts of China and other countries within one month since the first reports emerged. As of February 112020, 42,638 cases of confirmed infections and 1,016 deaths have been reported in mainland China.(2) Outside of China, there had been 319 confirmed cases and 1 death from 24 countries were reported as of February 10, 2020.(3) The outbreak of 2019-nCoV raised intense attention not only within China but internationally.(4) On 20 January 2020, the Chinese government added it to the Notifiable Communicable Disease List and gave the highest priority to its prevention and treatment.(5) On 31 January 2020, the World Health Organization (WHO) declared a public health emergency of international concern for China’s novel coronavirus.

Although the WHO said: “To date, there is no specific medicine recommended to prevent or treat the novel coronavirus”,(6) in China, historically, when the outbreak started, traditional Chinese medicine (TCM) approaches including oral administration of preventive herbal formulae, wearing Chinese medicine sachets, indoor herbal medicine fumigation, etc. were recommended for prevention and treatment.(7, 8) For example, in 2003, TCM approaches were used to prevent and treat severe acute respiratory syndrome (SARS)(9, 10), which was the most serious infectious disease outbreak in China prior to the COVID-19. In 2009, when the pandemic of influenza A(H1N1) around the world, the National Administration of TCM of China issued a TCM prevention program, which included four Chinese herbal formulae for adults of different body constitutions and one for children.(11) The current outbreak of COVID-19 resulted in many provinces in China issuing TCM prevention and control programs, among which the prevention programs are mainly oral Chinese herbal formulae. This study has reviewed the historical and human research evidence on TCM in preventing and control of infections in order to provide guidance for the prevention of COVID-19 pneumonia.

**Methods**

Three types of data were searched, including historical classics records, human research evidence, and current prevention programs.

1. Historical classics records: records on the prevention of epidemic diseases in ancient TCM books were searched, including history, treatment principles, medicines and applications of TCM to prevent epidemic disease.

2. Human research studies: studies to evaluate the preventive effects of TCM on contagious respiratory virus diseases were included. The inclusion criteria were as follows: (1) Study design: systematic review, clinical trials, cohort study, case-control study, or other population study without control. (2) Population: high-risk populations exposed to SARS or influenza A (H1N1). (3) Intervention: oral Chinese herbal formulae, including decoction, granules, or patent medicine. (4) Control: placebo, blank or without control group. (5) Outcome: infection rate defined as laboratory-confirmed incidence of disease.

3. Current prevention programs: TCM prevention programs for COVID-19 issued by the state or provincial health authorities in China. Considering that some provinces had regularly updated the programs according to the local prevalence and clinical practice, the most recent versions of the programs were included for analyses in this study.

**Literature search**

Retrieval strategy differed among the above three types of data. The first type of data was based on mainly manual retrieval of ancient books of TCM on epidemic diseases, supplemented by electronic database retrieval. The list of literature retrieved was determined by discussion among all authors. Secondly, we searched six databases including PubMed, Google Scholar, the Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang Data, and CQVIP database, with the key words of “severe acute respiratory syndrome” (or “SARS”), “influenza”, “H1N1”, “prevent\*” and “Chinese medicine” (pinyin: *zhongyi* or *zhongyao*). Thirdly, government websites or official media websites were searched for prevention programs on 2019-nCoV. Two authors (LH and TQL) conducted the literature search independently. The search date was up to February 8, 2020.

**Data extraction and analysis**

The following data were extracted and analyzed: source of evidence, time of publication or release, author, setting, basis for formulation of TCM prevention strategy, composition of Chinese medicine prescription, target disease, course of prevention, effect, and adverse reaction. The data was qualitatively described and presented, and if possible, quantitative or descriptive statistics were conducted.

**Results**

**Chinese herbal formula for preventing “pestilence” in ancient TCM classics**

The theory of prevention and treatment of “pestilence” (refers to fatal epidemic disease, Chinese pinyin: wenyi) in TCM originated from *Huangdi’s Internal Classic*, which was written about 2000 years ago.(12) It suggested two aspects which should be employed to prevent the spread of epidemics. One was to maintain and improve the healthy qi in the body by taking preventive medicine (*Xiaojin dan*, the first recommended formula of TCM to prevent pestilence.), healthy diet care, exercise and so on, so as to resist the invasion of external pathogen, and the other was to avoid the source of infection.(13) These two principles of epidemic disease prevention have been followed by TCM practitioners till now.(12, 14) such as, the Handbook of Prescriptions for Emergencies (*Zhouhou beiji fang*), Essential Prescriptions Worth a Thousand Gold for Emergencies (*Beiji qianjin yaofang*), Medical Secrets of an Official (*Waitai miyao*), Compendium of Materia Medica (*Bencao gangmu*), etc.(15) The famous doctor Sun Simiao (541-682 AD) expounded the basis of medicines to prevent “pestilence” in his book Essential Prescriptions Worth a Thousand Gold for Emergencies: “pestilence comes from nature, so to prevent it, we need to find medicinal herbs that also come from nature. People would not be infected if they know and take preventive medicine.”(16) A literature study compared the characteristics of medicinal formulae for preventing pestilence in different periods of ancient China, found that during the Jin and Tang Dynasties (3-10th century AD), medicinal formulaes were mainly used to eliminate the pathogenic factors, while Ming and Qing dynasties (14-20th century AD) focused on fortifying the spleen, resolving dampness, clearing heat, and detoxifying.(17)

Although many formulae for pestilence prevention were recorded in ancient TCM books, the case description of prevention was relatively rare. Through limited literature searches, we found an interesting case report: Su Shi (1037-1101 AD), a famous poet in the Northern Song Dynasty, accidentally found a formula for preventing pestilence named *ShengSanZi*, a powder consisting of 22 herbs. (18)Later, when he was demoted to Huangzhou, Hubei province, the pestilence had been outbreak for several years. He disclosed the prescription to the local people. After taking this formula, the number of patients with the disease was significantly reduced, and many lives were saved. This story was recorded by Su Shi himself, when he wrote a preface to his doctor friend Pang Anshi’s book General Treatise on Febrile Diseases (*Shanghan zongbing lun*).(18)

**Evidence of Chinese herbal formula for preventing SARS**

Three studies were identified including one controlled study (19) and two single cohort studies(20, 21) conducted during the epidemic of SARS.

Lau and colleagues (19) designed a controlled study to evaluate a herbal formula for prevention of SARS (no herbal intervention in control group) and conducted in Hong Kong, China. The sample size were 16437 (1063 in herbal group and 15374 in non-herbal group), and all participants were hospital care workers including doctors, nurses, and other staff. The result showed that none of the participants who took modified formula of Yupingfeng san plus Sangju yin contracted SARS, while 64 out of 15,347 (0.4%) in non-herbal group were infected with SARS (p=0.035). Nineteen cases (1.8%) appeared minor adverse effects after 14 days taking herbal medicine, including diarrhea, sore throat, dizziness, and nausea.

Both single cohort studies were conducted in Beijing, China with sample sizes of 3561(21) and 163(20), respectively. All participants were medical staff from two hospitals, where SARS patients were recruited and treated during the study period. Among them, Xu et al’s study (20) only included first-line medical staff in treating SARS. The courses of taking herbal formulae for prevention were 12-25d (21) respectively. The formulae used in these two studies were both classical formula Yupingfeng san plus some heat-clearing and detoxifying herbs. The results showed that none of the participants who took preventive herbal medicine had contracted SARS in the two studies. Information on the safety of the herbal medicines was not reported.

The details of prevention of the three studies are presented in **Table 1**.

**Table 1** Ingredients of herbal formulae for preventing SARS

|  |  |  |  |
| --- | --- | --- | --- |
| Study | Chinese name | Pinyin | Latin name |
| Lau JT 2005 (19) | 桑叶 | Sangye | *Folium mori* |
| 菊花 | Juhua | *Flos chrysanthemi* |
| 杏仁 | Xingren | *Semen armeniacae amarum* |
| 连翘 | Lianqiao | *Fructus forsythia* |
| 薄荷 | Bohe | *Herba menthae* |
| 桔梗 | Jiegeng | *Radix platycodonis* |
| 甘草 | Gancao | *Radix glycyrrhizae* |
| 芦根 | Lugen | *Rhizoma phragmitis* |
| 黄芪 | Huangqi | *Radix astragali* |
| 防风 | Fangfeng | *Radix saposhnikoviae* |
| 板蓝根 | Banlangen | *Folium isatidis* |
| 黄芩 | Huangqin | *Radix scutellariae* |
| Zhang L 2005 (21) | 黄芪 | Huangqi | *Radix astragali* |
| 白术 | Baizhu | *Rhizoma Atractylodis Macrocephalae* |
| 防风 | Fangfeng | *Radix saposhnikoviae* |
| 贯众 | Guanzhong | *Cyrtomium fortune J. Sm.* |
| 大青叶 | Daqingye | *Isatidis Folium* |
| 黄芩 | Huangqin | *Radix Scutellariae* |
| 滑石 | Huashi | *Talcum* |
| 甘草 | Gancao | *Radix glycyrrhizae* |
| Xu JY 2006 (20) | 金银花 | Jinyinhua | *Lonicerae Japonicae Flos* |
| 黄芪 | Huangqi | *Radix astragali* |
| 白术 | Baizhu | *Rhizoma Atractylodis Macrocephalae* |
| 防风 | Fangfeng | *Radix saposhnikoviae* |
| 沙参 | Shashen | *Glehniae Radix* |
| 冰糖 | Bingtang | *Crystal sugar* |

**Evidence of Chinese herbal formula for preventing influenza A(H1N1)**

Four studies were identified, including three (22-24) randomized controlled trials (RCTs) and one (25) non-randomized controlled clinical study. All the studies were conducted during the prevalence of influenza A (H1N1) in mainland China and published in Chinese. In these studies, participants were exposed to high-risk environments, such as hospitals and schools where influenza A (H1N1) occurred. The total sample size was 25,636 with the largest one of 25,329.(25) The tested herbal interventions included self-made herbal formulae and Chinese patent medicine; while in the control group, one used placebo and three used blank control. The course of herbal formulae ranged from 3 to 7 days, while the follow up ranged from 5 to 30 days. The outcome measure was infection rate of influenza A(H1N1), tested by laboratory serological diagnosis. One study reported that no adverse events occurred,(22) while the others did not report. The details of the characteristics of included trials are presented in **Table 2**.

The data on infection rate of influenza A (H1N1) from four studies were pooled in meta-analysis by using RevMan 5.3 software. The results showed that the infection rate in herbal formulae group was significantly lower than that in the control group (RR 0.36, 95% CI 0.24-0.52, P<0.01). A sensitivity analysis was conducted to exclude non-RCT and the results showed similar effect (RR 0.36; 95% CI 0.21-0.62, P<0.01). The results are showed in **Figure** 1.



**Figure 1** Meta-analysis of comparison between TCM prevention and control (blank or placebo) on infection rate of influenza A (H1N1)

**Table 2 C**haracteristics of included trials of herbal formulae for influenza A (H1N1)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study ID | Design type | Population | Average age (years) | Sample size (P/C) | Herbal intervention | Control | Course(d) | Follow up (d) | Outcome |
| Song YP 2019 (22) | RCT | ①② | P: 25.6±14.2C: 27.1±14.5 | 200 (100/100) | Jinghua qinggan granule | Placebo | 3 | 30 | Infection rate; Adverse event |
| Liu L 2013 (23) | RCT | ④ | P: 30.5±5.3C: 31.4±4.7 | 53(28/25) | Decoction of self-made formula\*1 | Blank | 7 | 10 | Infection rate |
| Xia BL 2010 (24) | RCT | ① | 23.5(18-26) | 54(27/27) | Kangbingdu oral liquid; Ganmao qingre granule | Blank | 3 | 14 | Infection rate |
| Liu BL 2010 (25) | CCT | ③ | Not report | 25329 (23947/1382) | Decoction of self-made formula\*2 | Blank | 5 | 5 | Infection rate |
| Note: ①population in close contact with 2009 influenza a(H1N1) patients;②susceptible population;③student;④medical staff in hospital emergency department; **CCT**: controlled clinical trial; **RCT**: randomized controlled trial; **RR**: relative risk; **CI**: confidence interval; **C**: control group; **P**: prevention group; Ingredients of Formulae: **\*1**紫草*Arnebiae Radix* (Zicao), 薄荷*Herba Menthae* (Bohe),甘草 *Radix Glycyrrhizae* (Gancao).**\*2**贯众 *Cyrtomium Fortune j. sm* (Guanzhong),金银花 *Lonicerae Japonicae Flos* (Jinyinhua),连翘*Fructus Forsythiae* (Lianqiao),板蓝根*Folium Isatidis* (Banlangen),牛蒡子*Fructus Arctii* (Niubangzi),藿香 *Herba Agastaches* (Huoxiang),竹叶 *Lophatheri Herba* (Zhuye),甘草*Radix Glycyrrhizae* (Gancao),大青叶*Isatidis Folium* (Daqingye). |

**Summary of official issued TCM recommendations for** COVID-19

Up to February 12, 2020, the National Health Commission of China has issued five versions of diagnosis and treatment programs for COVID-19, but none have included any content on TCM prevention and control, but on treatment since the third version.(26)

Of the 31 provinces (including autonomous regions, and municipalities) in mainland China, health authorities in 23 provinces had officially issued programs recommending herbal formulae to prevent COVID-19. These 23 provinces cover seven regions of mainland China: Northeast, North, Central (including Wuhan, Hubei province, the original outbreak of COVID-19), South, East, Northwest, and Southwest China. All programs were formulated by clinical experts organized by local health authorities according to local geographic and climate characteristics and COVID-19 prevalent conditions. The earliest program recommending TCM for prevention was issued by Sichuan Province on January 21, 2019. Ten provinces have updated their programs since the first announcement, seven of them have issued the second edition and three issued the third edition. The applicable population of preventive programs included general and special population (such as the elderly, children, pregnant women, patients with chronic comorbidity diseases). Different groups of populations had specified preventive TCM formulae. The programs issued by the 23 provinces included TCM formulae ranging from 1 up to 10, with an average of 3.4 per program. With regard to the course of TCM formulae for prevention, 11 provinces recommended from 3 to 14 days, while 12 provinces did not mention. In addition, Tibet Autonomous Region recommended Tibetan medicine and Guizhou province recommended Miao medicine formulae (one of the minority folk medicines). The basic characteristics of 23 provincial programs are shown in **Table 3**.

We counted the frequency of the herbs used in TCM formulae for prevention of general population issued by the 23 provinces. The results showed that these formulae contained 54 different herbs, of which 19 herbs with a frequency of use for three or more times in preventive formulae for general population (**Figure** 2). The top two were黄芪Astragali Radix (Huangqi) and 甘草Glycyrrhizae Radix Et Rhizoma(Gancao).

**Figure 2**  Frequency of commonly used herbs in the preventive formulae for COVID-19.

**Table 3** The characteristics of TCM prevention programs for COVID-19 issued by 23 provinces in mainland China

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Region | Province | Date | Applicable population | Number of formulae | Composition of formula (Chinese characters / Latin / Pinyin / dosage) for general population  | Course | Edition  | Source |
| Northeast | Heilongjiang | 2020/2/1 | general population; elderly; children | 8 | 金银花*Lonicerae Japonicae Flos* (Jinyinhua) 15g, 连翘 *Fructus Forsythiae* (Lianqiao) 15g, 生白术 *Rhizoma Atractylodis Macrocephalae* (Shengbaizhu) 15g, 佩兰 *Eupatorium fortunei* (Peilan) 10g, 桑叶 *Folium Mori* (Sangye) 10g, 桔梗 *Radix Platycodonis* (Jiegeng) 10g, 甘草*Radix Glycyrrhizae* (gancao) 5g  | NR | 2nd | <https://m.dbw.cn/heilongjiang/system/2020/02/02/058330150.shtml> |
| North  | Beijing | 2020/1/29 | general population; general population with difference TCM body constitution; children; population in close contact with 2019-nCoV patients; population with chronic comorbidity diseases  | 4 | 麦冬 *Radix Ophiopogonis* (Maidong) 3g, 桑叶 *Folium Mori* (Sangye) 3g, 菊花 *Flos Chrysanthemi* (Juhua) 3g, 陈皮 *Citri Reticulatae Pericarpium* (Chenpi) 2g | 6d | 2nd | <http://zyj.beijing.gov.cn/sy/tzgg/202001/t20200130_1621630.html> |
| Tianjin  | 2020/1/29 | general population with difference TCM body constitution; population in close contact with 2019-nCoV patients  | 4 | 柴胡 *Radix Bupleuri* (Chaihu) 18g, 黄芩 *Radix Scutellariae* (Huangqin) 12g, 枳壳 *Fructus Aurantii* (Zhiqiao) 12g, 桔梗*Radix Platycodonis* (Jiegeng)10g, 厚朴*Cortex Magnoliae Officinalis* (Houpu) 12g, 槟榔 *Semen Arecae* (Binlang) 18g, 金银花*Lonicerae Japonicae Flos* (Jinyinhua) 15g, 贯众 *Cyrtomium fortune J. Sm.* (Guanzhong) 10g, 草果*Fructus Tsaoko* (Caoguo) 6g, 青皮 *Pericarpium Citri Reticulatae Viride* (Qingpi) 6g, 佩兰 *Eupatorium fortunei* (Peilan) 10g, 荷梗*Petiolus Nelumbinis* (Hegeng)6g, 生黄芪 *Radix Astragali seu Hedysari* (Shenghuangqi) 18g, 炙甘草*Glycyrrhizae Radix Et Rhizoma Praeparata Cum Melle* (Zhigancao) 6g | 5-14d | 2nd | <http://www.tjnk.gov.cn/att/0/10/04/16/10041623_922951.pdf> |
| Hebei | 2020/1/31 | general population; elderly; children; pregnant women  | 8 | 黄芪*Radix Astragali seu Hedysari* (Huangqi) 15g, 连翘*Fructus Forsythiae* (Lianqiao) 9g, 麦冬 *Radix Ophiopogonis* (Maidong) 10g, 苍术 *Atractylodis Rhizoma* (Cangzhu) 12g, 桔梗 *Radix Platycodonis* (Jiegeng) 9g, 甘草*Radix Glycyrrhizae* (Gancao) 6g, 藿香*Herba Agastaches* (Huoxiang) 9g | NR | 3rd | <http://www.hebwst.gov.cn/apps/cms/docforward.do?id=396033>  |
| Shanxi | 2020/2/1 | general population with difference TCM body constitution  | 2 | 生黄芪*Astragalus mongholicus Bunge (Shenghuangqi)* 12g, 白术*Rhizoma Atractylodis Macrocephalae (baizhu)* 9g, 防风 *Saposhnikoviae Radix* (Fangfeng) 9g, 藿香 *Herba Agastaches* (Huoxiang) 6g, 北沙参 *Radix Glehniae* (Beishashen) 12g, 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 9g, 百合 *Bulbus Lilii* (Baihe) 12g, 贯众*Cyrtomium fortunei J. Sm.* (Guanzhong) 6g, 连翘 *Fructus Forsythiae* (Lianqiao) 9g | NR | 1st | <http://www.sx.chinanews.com/news/2020/0201/162758.html>  |
| Central  | Henan | 2020/1/27 | general population; general population with difference TCM body constitution; children; population in close contact with 2019-nCoV patients | 10 | 生黄芪*Astragalus mongholicus Bunge* (Shenghuangqi) 9g, 射干*Rhizoma Belamcandae* (Shegan) 5g, 北沙参*Radix Glehniae* (Beishashen) 9g, 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 9g, 苍术 *Atractylodis Rhizoma* (Cangzhu) 9g, 藿香*Herba Agastaches* (Huoxiang) 6g, 贯众 *Cyrtomium fortunei J. Sm.* (Guanzhong) 5g | 6d | 1st | <http://www.lywwj.gov.cn/bencandy.php?fid=146&id=14268>  |
| Hubei | 2020/1/23 | general population; children | 2 | 生黄芪*Astragalus mongholicus Bunge* (Shenghuangqi) 10g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 10g, 防风 *Saposhnikoviae Radix* (Fangfeng) 10g, 贯众 *Cyrtomium fortunei J. Sm.* (Guanzhong) 6g, 金银花*Lonicerae Japonicae Flos* (Jinyinhua) 10g, 佩兰 *Eupatorium fortunei* (Peilan) 10g, 陈皮 *Citri Reticulatae Pericarpium* (Chenpi) 6g | 7-10d | 2nd | <http://feng.ifeng.com/c/7tWzQkkpuQm>  |
| Hunan | 2020/2/3 | general population with difference TCM body constitution | 2 | 黄芪*Radix Astragali seu Hedysari* (Huangqi) 15g, 桂枝*Ramulus Cinnamomi* (Guizhi) 10g, 白芍*Radix Paeoniae Alba* (Baishao) 10g, 苍术*Atractylodis Rhizoma* (Cangzhu) 10g, 防风 *Saposhnikoviae Radix* (Fangfeng) 10g, 葛根 *Radix Puerariae* (Gegen) 15g, 干姜 *Rhizoma Zingiberis* (Ganjiang) 10g, 甘草*Radix Glycyrrhizae* (Gancao) 10g, 大枣*Fructus Jujubae* (Dazao) 10g | 3d | 3rd | <http://tcm.hunan.gov.cn/tcm/xxgk/tzgg/202002/t20200203_11168981.html>  |
| South  | Hainan | 2020/2/3 | general population  | 1 | 黄芪*Radix Astragali seu Hedysari* (Huangqi) 20g, 白术 *Rhizoma Atractylodis Macrocephalae* (Baizhu) 15g, 防风*Saposhnikoviae Radix* (Fangfeng) 10g, 赤芍*Radix Paeoniae Rubra* (Chishao) 10g, 连翘*Fructus Forsythiae* (Lianqiao) 10g, 板蓝根*Radix Isatidis* (Banlangen) 15g, 甘草*Radix Glycyrrhizae* (Gancao) 10g | NR | 2nd | <http://wanning.hainan.gov.cn/wanning/rdzt/fkyq/kpzs/202002/t20200205_2744485.html>  |
| Guangxi | 2020/1/31 | general population; children; population in close contact with 2019-nCoV patients | 3 | 苍术 *Atractylodis Rhizoma* (Cangzhu) 10g, 苏叶*Folium Perillae* (Suye) 10g, 陈皮*Citri Reticulatae Pericarpium* (Chenpi) 10g, 葛根 *Radix Puerariae* (Gegen) 10g, 板蓝根 *Radix Isatidis* (Banlangen)10g, 生姜*Rhizoma Zingiberis Recens* (Shengjiang) 20g | NR | 1st | <http://gx.people.com.cn/n2/2020/0131/c179430-33753679.html>  |
| East   | Jiangxi | 2020/2/5 | general population  | 2 | 生黄芪*Astragalus mongholicus Bunge (Shenghuangqi)* 12g, 防风*Saposhnikoviae Radix* (Fangfeng) 10g, 白术 *Rhizoma Atractylodis Macrocephalae* (Baizhu) 10g, 银花*Lonicerae Japonicae Flos* (Yinhua) 10g, 连翘 *Fructus Forsythiae* (Lianqiao) 10g, 贯众 *Cyrtomium fortune J. Sm.* (Guanzhong) 6g, 佩兰 *Eupatorium fortunei* (Peilan) 10g, 陈皮*Citri Reticulatae Pericarpium* (Chenpi) 10g, 苍术 *Atractylodis Rhizoma* (Cangzhu) 10g, 桔梗 *Radix Platycodonis* (Jiegeng) 10g | NR | 2nd | <http://wjw.yichun.gov.cn/news-show-562908.html>  |
| Shandong | 2020/1/28 | general population; elderly; children; population in close contact with 2019-nCoV patients; population with chronic comorbidity diseases; pregnant women; medical staff | 9 | 黄芪*Radix Astragali seu Hedysari* (Huangqi) 10g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 10g, 防风 *Saposhnikoviae Radix* (Fangfeng) 6g, 太子参 *Radix Pseudostellariae* (Taizishen) 12g, 麦冬 *Radix Ophiopogonis* (Maidong) 10g, 连翘 *Fructus Forsythiae* (Lianqiao) 10g, 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 15g, 薏苡仁 *Semen Coicis* (Yiyiren) 12g, 茯苓Poria (Fuling) 9g, 苏叶 *Folium Perillae* (Suye) 6g, 炙甘草*Glycyrrhizae Radix Et Rhizoma Praeparata Cum Melle* (Zhigancao) 3g | 5d | 1st | <http://jnjy.jining.gov.cn/art/2020/1/29/art_14566_2442287.html> |
| Zhejiang | NR | population in close contact with 2019-nCoV patients  | 1 | 金银花*Lonicerae Japonicae Flos* (Jinyinhua) 15g, 连翘 *Fructus Forsythiae* (Lianqiao) 15g, 黄芪*Radix Astragali seu Hedysari* (Huangqi) 15g, 防风 *Saposhnikoviae Radix* (Fangfeng) 10g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 15g, 牛蒡子*Fructus Arctii* (Niubangzi) 15g, 芦根*Rhizoma Phragmitis* (Lugen) 30g, 甘草*Radix Glycyrrhizae* (Gancao) 6g | NR | 3rd | <http://www.qzszyy.com/mobile/info/10093>  |
| Jiangsu | 2020/1/29 | general population with difference TCM body constitution; medical staff | 2 | Formula 1: 党参 *Radix Codonopsis* (Dangshen), 黄精*Rhizoma Polygonati* (Huangjing), 白术 *Rhizoma Atractylodis Macrocephalae* (baizhu), 陈皮 *Citri Reticulatae Pericarpium* (Chenpi), 苏叶*Folium Perillae* (Suye) , 大枣 *Fructus Jujubae* (Dazao), 炙甘草*Glycyrrhizae Radix Et Rhizoma Praeparata Cum Melle* (Zhigancao)Formula 2:黄芪*Radix Astragali seu Hedysari* (Huangqi), 苏叶 *Folium Perillae* (Suye) , 防风 *Saposhnikoviae Radix* (Fangfeng), 金银花 *Lonicerae Japonicae Flos* (Jinyinhua), 薄荷 *Herba Menthae Heplocalycis* (Bohe), 麦冬*Radix Ophiopogonis* (Maidong) , 甘草*Radix Glycyrrhizae* (Gancao) | NR | 1st | <http://rd.cnsn.gov.cn/snrd/zfgzdt/202001/5b037c9cddd841d08a95663071e4d21e.shtml>  |
| Anhui | 2020/1/22 | general population  | 2 | 黄芪 *Radix Astragali seu Hedysari* (Huangqi) 20g, 麦冬 *Radix Ophiopogonis* (Maidong) 10g, 苍术 *Atractylodis Rhizoma* (Cangzhu)8g, 防风 *Saposhnikoviae Radix* (Fangfeng) 6g, 藿香 *Herba Agastaches* (Huoxiang) 10g, 荆芥*Herba Schizonepetae* (Jingjie) 10g, 甘草*Radix Glycyrrhizae* (Gancao) 6g | 5-7d | 1st | <http://wjw.ah.gov.cn/ahtcm/NewsDetail.aspx?id=940>  |
| Northwest  | Shaanxi | 2020/1/23 | general population; children | 2 | 生黄芪*Astragalus mongholicus Bunge* (Shenghuangqi) 15g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 10g, 防风 *Saposhnikoviae Radix* (Fangfeng)6g, 百合 *Bulbus Lilii* (Baihe) 30g, 石斛*Herba Dendrobii* (Shihu) 10g, 梨皮*Pericarpium Pyri Bretschneideri* (Lipi)30g, 桔梗 *Radix Platycodonis* (Jiegeng)10g, 芦根*Rhizoma Phragmitis* (Lugen) 30g, 甘草*Radix Glycyrrhizae* (Gancao) 6g | 3-5d | 1st | <http://sxwjw.shaanxi.gov.cn/art/2020/1/23/art_10_67378.html>  |
| Gansu | 2020/2/1 | general population; general population with difference TCM body constitution; population in close contact with 2019-nCoV patients  | 3 | 贯众*Cyrtomium fortunei J. Sm.* (Guanzhong) 9-12g, 苏梗*Caulis Perillae* (Sugeng)12-15g, 淡豆豉*Semen Sojae Preparatum* (Dandouchi) 3-6g, 苍术*Atractylodis Rhizoma* (Cangzhu) 6-9g, 荷叶*Folium Nelumbinis* (Heye)3-6g, 薏苡仁 *Semen Coicis* (Yiyiren) 30-50g | NR | 2nd | <http://www.yongchang.gov.cn/publicity/zcjd/szcjjd__zcjd/szcjjd/33459>  |
| Ningxia | 2020/1/28 | general population; general population with difference TCM body constitution; population in close contact with 2019-nCoV patients; medical staff | 1 | 黄芪*Radix Astragali seu Hedysari* (Huangqi) 15g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 15g, 防风 *Saposhnikoviae Radix* (Fangfeng) 10g, 薏苡仁 *Semen Coicis* (Yiyiren) 20g, 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 10g, 紫苏叶 *Folium Perillae* (Zisuye) 6g,杏仁*Semen Armeniacae Amarum* (Xingren)10g, 桔梗 *Radix Platycodonis* (Jiegeng) 12g, 芦根 *Rhizoma Phragmitis* (Lugen)10g, 炙甘草*Glycyrrhizae Radix Et Rhizoma Praeparata Cum Melle* (Zhigancao) 6g | 7d | 1st | <http://wsjkw.nx.gov.cn/info/1040/13360.htm>  |
| Southwest  | Sichuan | 2020/1/21 | general population; children  | 1 | 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 30g, 连翘 *Fructus Forsythiae* (Lianqiao) 30g, 芦根 *Rhizoma Phragmitis* (Lugen) 30g, 竹叶*Lophatheri Herba* (Zhuye) 15g, 薄荷*Herba Menthae Heplocalycis* (Bohe) 15g, 荆芥*Herba Schizonepetae* (Jingjie)15g, 桔梗*Radix Platycodonis* (Jiegeng) 15g,甘草*Radix Glycyrrhizae* (Gancao) 15g, 藿香 *Herba Agastaches* (Huoxiang) 15g | NR | 1st | <http://sc.people.com.cn/n2/2020/0121/c345167-33736981.html>  |
| Yunnan | 2020/1/25 | general population with difference TCM body constitution  | 2 | Formula 1: 北沙参*Radix Glehniae (Beishashen)* 15g, 桑叶 *Folium Mori* (Sangye) 9g, 金银花 *Lonicerae Japonicae Flos* (Jinyinhua) 9g, 菊花 *Flos Chrysanthemi* (Juhua) 9g, 桔梗 *Radix Platycodonis* (Jiegeng) 9g, 甘草 *Radix Glycyrrhizae* (Gancao) 6gFormula 2:生黄芪 *Astragalus mongholicus Bunge* (Shenghuangqi) 15g,白术 *Rhizoma Atractylodis Macrocephalae* (Baizhu) 15g, 防风 *Saposhnikoviae Radix* (Fangfeng) 9g, 藿香 *Herba Agastaches* (Huoxiang) 9g, 苏叶 *Folium Perillae* (Suye) 10g, 炙甘草*Glycyrrhizae Radix Et Rhizoma Praeparata Cum Melle* (Zhigancao) 6g | 3d | 1st | <https://mp.weixin.qq.com/s/TEbHrEdw170n0c3Dto8b_w>  |
| Chongqing | 2020/2/1 | general population  | 1 | 生黄芪*Astragalus mongholicus Bunge* (Shenghuangqi) 10g, 白术*Rhizoma Atractylodis Macrocephalae* (Baizhu) 10g, 防风 *Saposhnikoviae Radix* (Fangfeng) 6g, 北沙参 *Radix Glehniae* (Beishashen) 15g, 芦根 *Rhizoma Phragmitis* (Lugen) 10g, 藿香 *Herba Agastaches* (Huoxiang) 12g, 连翘*Fructus Forsythiae* (Lianqiao) 9g, 板蓝根 *Radix Isatidis (Banlangen)* 9g, 甘草*Radix Glycyrrhizae* (Gancao) 3g | 3-5d | 1st | <https://www.cqcb.com/hot/2020-02-01/2137736_pc.html>  |
| Guizhou | 2020/1/22 | general population; children | 3 | 北沙参 *Radix Glehniae* (Beishashen)10g, 玉竹*Rhizoma Polygonati Odorati* (Yuzhu) 20g, 石斛*Herba Dendrobii* (Shihu)20g, 贯众 *Cyrtomium fortune J. Sm.* (Guanzhong) 20g, 苍术 *Atractylodis Rhizoma* (Cangzhu) 10g, 石菖蒲*Rhizoma Acori Tatarinowii* (Shichangpu) 10g | NR | 1st | <http://www.gz.xinhuanet.com/2020-01/22/c_1125494617.htm>  |
| Xizang (Tibet) | 2020/1/26 | general population | 6 | 催汤丸 Cuitang pill, 七味珍宝汤（散）Qiwei Zhenbao decotion (powder), 四味木香汤（散）Siwei Muxiang decotion (powder), 仁青常觉Renqing Changjue pill, 仁青芒觉Renqing Mangjue pill, 流感丸Liugan pill | NR | 1st | <http://app.myzaker.com/news/article.php?pk=5e2f9f06b15ec02f0b359ed5>  |
| **\*Note:** ①general population; ②general population with difference TCM body constitution; ③elderly; ④children; ⑤pregnant women; ⑥population in close contact with 2019-nCoV patients; ⑦population with chronic comorbidity diseases; medical staff.medical staff. **NR**: not report.  |

**Discussion**

As a new emerging acute respiratory infectious disease, COVID-19 lacks effective methods to control and treat the infection. It is urgent and reasonable to explore effective intervention strategies from traditional medicine for its prevention. This study examines the historical records for infection prevention in TCM, as well as previous clinical evidence on TCM prevention for similar public health emergencies such as SARS and influenza A (H1N1). Recorded literature showed that the use of TCM to prevent epidemics of infectious diseases can be traced back to ancient Chinese practice over thousands of years, and its successful effects were preliminarily substantiated by modern human clinical researches when applied to SARS and influenza A (H1N1) epidemics suggesting that historical TCM experience is a worthwhile approach.

Based on the comprehensive analyses of the prevention programs issued by 23 provinces since the COVID-19 outbreak, we found that the main TCM principles in preventing COVID-19 were to tonify qi to protect and provide defense from external pathogens, disperse wind and discharge heat, and resolve dampness with aroma. It was also similar to the characteristics of herbal formulae for preventing “pestilence” in ancient times and SARS in 2003.(17, 19) The six most commonly used herbs were *Astragali Radix* (Huangqi), *Glycyrrhizae Radix Et Rhizoma* (Gancao), *Saposhnikoviae Radix* (Fangfeng), *Atractylodis Macrocephalae Rhizoma* (Baizhu), *Lonicerae Japonicae Flos* (Jinyinhua), and *Forsythiae Fructus* (Lianqiao). Huangqi, Fangfeng, and Baizhu are all ingredients of a classical herbal formula Yupingfeng san (powder), for tonifying qi to protect from external pathogens. In Lao JT et al’s controlled study of TCM formula for preventing SARS, Yupingfeng san was also the main ingredients. (19) Some studies have confirmed that Yupingfeng san has antiviral, anti-inflammatory and immunoregulatory effects. (28, 29) Jinyinhua and Lianqiao are the core components of Yinqiao san (powder), which is a classical formula used to prevent and treat respiratory infectious diseases in ancient. An experimental study found that the effect of Yinqiao san in the prevention treatment of upper respiratory tract infection could be explained by its antibacterial and antiviral properties, and improving of the function of upper respiratory mucosal immune system.(30) A multicenter, large-scale, randomized trial found that maxingshigan–yinqiaosan could reduce time to fever resolution in patients with the H1N1 influenza virus infection.(31)

At present, the National Health Commission of China has not issued a TCM prevention program for COVID-19. The reasons may be, first, according to the TCM theory of three-factors concerned treatment (*Sanyin Zhiyi*, 三因制宜) of TCM, due to the differences of individual, regional, and seasonal factors in the occurrence and distribution of diseases, these factors should be considered in prevention and treatment;(32) and second, lack of solid evidence of TCM formula for COVID-19. By comparing and analyzing the prevention programs issued by provincial levels, we also found that there was slight regional difference in the recommended herbal formulae and prescription principles. For example, due to the dry climate in northern China, there are additional one or two herbs for nourishing yin in the formula, like *Glehniae Radix* (Beishashen) and *Ophiopogonis Radix* (Maidong), while in the south, due to the humid climate, aromatic herbs with the function of resolving dampness and turbidity are used in the formulae, like *Pogostemonis Herba* (Huoxiang) and *Eupatorii Herba* (Peilan).

Individual difference was also considered in the prevention programs in some provinces. There were two or more formulae recommended in 18 provinces’ programs, which were applicable for different populations, such as the elderly, children, pregnant women, or patients with chronic comorbidity diseases, population in close contact with COVID-19 patients, etc. In addition, seven provinces or province-level municipality (Beijing, Tianjin, Shanxi, Henan, Hunan, Shandong, Yunnan) recommended formulae according to the types of TCM body constitutions of the population. This tailored prevention strategy might help to improve the preventive effect.

We suggest that the safety should also be paid attention to when taking Chinese herbal formula to prevent COVID-19, especially when they are used for long period of times. The public should choose the prescriptions under the guidance of TCM doctors according to the program issued by provincial health authorities, and avoid taking the prescriptions or herbs with unknown origin and without officially approval. It should also be noted that the prevention advice for taking decoctions were not reported in the 12 provinces’ program. According to the programs of other provinces, it is appropriate to take the decoction for one week.

Based on the consideration of health economics and balance of risks and benefits, we do not recommend that all people should take Chinese herbal medicine to prevent COVID-19. Due to the highly contagion,(33, 34) high-risk populations exposed to COVID-19 patients, including medical personnel, family members, and other people who are in close contact with COVID-19 patients, as well as residents living in COVID-19 outbreak areas, would probably benefit from taking Chinese herbal medicine formulae for prevention. These formulae recommended in the prevention programs are easily available in pharmacies and hospitals across the country.

There are some limitations within this study. Firstly, historical records of using TCM for “pestilence” prevention were examined in the review, however, the term “pestilence” might be a broad concept in ancient TCM books, including infectious diseases transmitted through respiratory tract, digestive tract and other ways, so it might not be completely representative of the respiratory viral diseases especially the COVID-19. Secondly, as there is no direct clinical evidence for the prevention of the new emerging COVID-19. Currently reported researches were from previous literature on the prevention of SARS and influenza A (H1N1) by TCM which can only be considered as indirect evidence to refer to the current outbreak. Thirdly, the prevention programs for preventing 2019-nCoV were issued shortly after the outbreak, which were formulated by TCM experts based on their previous experience in the prevention and treatment of similar diseases and their initial understanding of the disease; therefore, the actual effect of these programs needs to be verified in clinical application, and updated and improved according to the evidence of new researches on COVID-19 .

For future studies, we recommend prospective cohort studies, randomized controlled trials or registry studies to evaluate the effect of TCM formulae in prevention of COVID-19. At present, as the COVID-19 has not yet been controlled, we expect that a series of prospective population studies with rigorous design and large sample should commence with protocol registration, ethical approval, and implementation in a timely manner, to produce reliable evidence for TCM prevention of COVID-19 or similar emerging respiratory infectious diseases in future.

**Conclusion**

Based on historical records and clinical evidence of SARS and influenza A (H1N1) prevention, traditional Chinese herbal formula could be an alternative approach for the prevention of COVID-19 in high-risk population while waiting for the development of a successful vaccine. Prospective well design population studies are needed to evaluate the preventive effect of TCM.

**Conflicts of interest**

The authors declare that they have no competing interest.

**Author contributions**

Hui Luo, Qiaoling Tang, and Jianping Liu conceived of the design and carried out the study. Qiaoling Tang undertook the literature review of historical evidence and assisted in writing the manuscript. Yaxi Shangand Shibing Liang translated and assisted in analyzing Chinese data. Ming Yang provided suggestions for the design of study. Hui Luo undertook the literature review of prevention programs and wrote the manuscript. Jianping Liu supervised the study and revised the manuscript. Nicola Robinson revised the manuscript and provided important perspectives. All authors read and approved the final manuscript.

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