

## Gan Cao (Radix Glycyrrhizae)



## 甘草 甘草

**Pinyin Name:** *Gan Cao*

**Literal Name:** “sweet herb,” “sweet grass”

**Alternate Chinese Names:** *Guo Lao*

**Original Source:** *Shen Nong Ben Cao Jing* (Divine Husbandman’s Classic of the Materia Medica) in the second century

**English Name:** licorice root (British spelling: liquorice)

**Botanical Name:** *Glycyrrhiza uralensis* Fisch. (*Gan Cao*);  
*Glycyrrhiza inflata* Bat. (*Zhang Guo Gan Cao*);  
*Glycyrrhiza qlabra* L. (*Guang Guo Gan Cao*)

**Pharmaceutical Name:** Radix Glycyrrhizae

**Properties:** sweet, neutral

**Channels Entered:** Spleen, Stomach, Lung and Heart

### CHINESE THERAPEUTIC ACTIONS

#### 1. Tonifies Spleen, Benefits Qi

**Spleen and Stomach deficiencies:** *Gan Cao* (Radix Glycyrrhizae) tonifies the middle *jiao* to enhance the transformation and transportation functions of the Spleen and Stomach. Clinically, it treats disorders such as shortness of breath, fatigue, sallow facial appearance, decreased food intake, loose stools, and diarrhea. The honey-fried herb, *Zhi Gan Cao* (Radix Glycyrrhizae Preparata), is stronger than the unprocessed herb for tonification of qi.

- Deficiency of Spleen and Stomach qi: combine *Gan Cao* with *Ren Shen* (Radix Ginseng), *Bai Zhu* (Rhizoma Atractylodis Macrocephalae) and *Fu Ling* (Poria). **Exemplar Formula:** *Si Jun Zi Tang* (Four-Gentleman Decoction).

**Palpitations, arrhythmia and intermittent pulse:** These conditions may occur as a result of qi and blood deficiencies of the Heart. Clinically, *Gan Cao* treats patients with palpitations and irregular or intermittent pulse with deficiency and cold. Honey-fried *Gan Cao* is best used for this condition.

- Palpitations with irregular or intermittent pulse: use it with *Ren Shen* (Radix Ginseng), *Sheng Di Huang* (Radix Rehmanniae), *E Jiao* (Colla Corii Asini) and *Gui Zhi* (Ramulus Cinnamomi). **Exemplar Formula:** *Zhi Gan Cao Tang* (Honey-Fried Licorice Decoction).

**Zang zao (dry organ) disorder:** This is a condition characterized by Heart deficiency and Liver qi stagnation with a wan appearance, disturbed sleep, and emotional instability. *Gan Cao* treats this condition by tonifying qi, nourishing the Heart and harmonizing the middle *jiao*.

- *Zang zao* disorder: use *Gan Cao* with *Da Zao* (Fructus Jujubae) and *Xiao Mai* (Fructus Tritici). **Exemplar Formula:** *Gan Mai Da Zao Tang* (Licorice, Wheat, and Jujube Decoction).
- *Zang zao* disorder with *shen* (spirit) disturbance: combine this herb with *Da Zao* (Fructus Jujubae), *Xiao Mai* (Fructus Tritici), *Long Gu* (Os Draconis), *Mu Li* (Concha Ostreae), *Suan Zao Ren* (Semen Zizyphi Spinosaes) and *Bai Zi Ren* (Semen Platycladi).

#### 2. Moistens the Lung, Stops Cough

**Cough or dyspnea:** *Gan Cao* moistens the Lung, nourishes qi, dispels phlegm and stops cough. Neutral in property and mild in action, it treats coughing and wheezing of various etiologies, including cold or heat, and deficiency or excess, with or without phlegm.

- *Wei* (atrophy) syndrome of the Lung with chronic cough: use *Gan Cao* alone.
- Cough and wheezing caused by wind-cold: use it with *Ma Huang* (Herba Ephedrae), *Xing Ren* (Semen Armeniacae Amarum) and *Sheng Jiang* (Rhizoma Zingiberis Recens). **Exemplar Formula:** *San Ao Tang* (Three-Unbinding Decoction).
- Cough and wheezing due to wind-heat: combine this herb with *Sang Ye* (Folium Mori), *Ju Hua* (Flos Chrysanthemi), *Jie Geng* (Radix Platycodonis) and *Xing Ren* (Semen Armeniacae Amarum). **Exemplar Formula:** *Sang Ju Yin* (Mulberry Leaf and Chrysanthemum Decoction).
- Cough and wheezing due to Lung heat: use this herb with *Shi Gao* (Gypsum Fibrosum), *Ma Huang* (Herba Ephedrae), and *Xing Ren* (Semen Armeniacae Amarum). **Exemplar Formula:** *Ma Xing Gan Shi Tang* (Ephedra, Apricot Kernel, Licorice, and Gypsum Decoction).
- Cough and wheezing due to Lung cold, with sputum:

# Gan Cao (Radix Glycyrrhizae)

add it to *Gan Jiang* (Rhizoma Zingiberis), *Xi Xin* (Herba Asari), and *Wu Wei Zi* (Fructus Schisandrae Chinensis).

**Exemplar Formula:** *Xiao Qing Long Tang* (Minor Bluegreen Dragon Decoction).

- Cough and wheezing because of dryness: use *Gan Cao* with *Bei Sha Shen* (Radix Glehniae), *Mai Men Dong* (Radix Ophiopogonis), *E Jiao* (Colla Corii Asini) and *Kuan Dong Hua* (Flos Farfarae).

### 3. Relieves Pain

**Epigastric, abdominal, musculoskeletal and smooth muscle pain and cramps:** The Spleen dominates muscles and the Liver controls tendons. Therefore, patients with Spleen deficiency and Liver excess often experience muscle cramps and pain, especially in epigastric and abdominal tissues. *Gan Cao* has excellent properties to relieve pain and cramps of smooth or skeletal muscles by tonifying the Spleen and replenishing qi.

- Pain and cramps of smooth or skeletal muscles: combine *Gan Cao* with *Bai Shao* (Radix Paeoniae Alba).

**Exemplar Formula:** *Shao Yao Gan Cao Tang* (Peony and Licorice Decoction).

- Abdominal pain due to deficiency and cold of the middle *jiao*: use this herb with *Shan Yao* (Rhizoma Dioscoreae), *Yi Tang* (Saccharum Granorum), *Gui Zhi* (Ramulus Cinnamomi), *Sheng Jiang* (Rhizoma Zingiberis Recens) and *Da Zao* (Fructus Jujubae).
- Diarrhea, dysentery and abdominal pain caused by damp-heat: combine *Gan Cao* with *Bai Shao* (Radix Paeoniae Alba), *Huang Lian* (Rhizoma Coptidis), *Huang Qin* (Radix Scutellariae), *Da Huang* (Radix et Rhizoma Rhei) and *Bing Lang* (Semen Arecae). **Exemplar Formula:** *Shao Yao Tang* (Peony Decoction).
- Hypochondriac pain due to Liver qi stagnation: use this herb with *Bai Shao* (Radix Paeoniae Alba), *Chai Hu* (Radix Bupleuri), *Dang Gui* (Radix Angelicae Sinensis) and *Bai Zhu* (Rhizoma Atractylodis Macrocephalae). **Exemplar Formula:** *Xiao Yao San* (Rambling Powder).
- Epigastric pain caused by stomach ulcer: add this herb to *Hai Piao Xiao* (Endoconcha Sepiae), *Wa Leng Zi* (Concha Arcae), *Chen Pi* (Pericarpium Citri Reticulatae) and honey.
- Leg cramps due to blood deficiency: use it with *Bai Shao* (Radix Paeoniae Alba), *Mu Gua* (Fructus Chaenomelis) and *Ji Xue Teng* (Caulis Spatholobi).

### 4. Clears Heat, Eliminates Toxins

**Sores, swellings and carbuncles:** The fresh or unprocessed form of *Gan Cao* is used to clear heat and eliminate toxins. It may be used internally or topically to treat various sores and ulcers characterized by heat and toxins.

- Uncomplicated sores or lesions: use *Gan Cao* alone, topically or internally.

- Erysipelas: use it alone as decoction and apply topically.
- Red lesions with eczema and itching: apply decoction of *Gan Cao* topically.
- Yang sores with redness, swelling and pain: use it with *Jin Yin Hua* (Flos Lonicerae), *Lian Qiao* (Fructus Forsythiae), *Zi Hua Di Ding* (Herba Violae) and *Pu Gong Ying* (Herba Taraxaci).
- Yin sores with dark-purplish appearance: add it to *Shu Di Huang* (Radix Rehmanniae Preparata), *Rou Gui* (Cortex Cinnamomi), *Lu Jiao Jiao* (Gelatinum Cornu Cervi) and *Bai Jie Zi* (Semen Sinapis). **Exemplar Formula:** *Yang He Tang* (Yang-Heartening Decoction).
- Burns: mix *Gan Cao* with honey for topical application. Frostbite: use it with an equal portion of *Yuan Hua* (Flos Genkwa) and apply topically as an herbal wash.

**Sore throat:** *Gan Cao* relieves soreness, swelling and pain in the throat, a condition characterized by the presence of heat and toxins. It may be used alone or in combination with other herbs. If heat is not severe and the throat is not extremely red, *Gan Cao* can be used alone.

- Sore throat: use it with *Jie Geng* (Radix Platycodonis). **Exemplar Formula:** *Jie Geng Tang* (Platycodon Decoction).
- Severe sore throat with redness, swelling, and pus: combine this herb with *Jie Geng* (Radix Platycodonis), *Shan Dou Gen* (Radix Sophorae Tonkinensis), *Xuan Shen* (Radix Scrophulariae), and *Niu Bang Zi* (Fructus Arctii).

### 5. Treats Poisoning

**Poisoning:** *Gan Cao* is useful as an antidote for various poisonings, including but not limited to food, herbs, herbicides, pesticides, drugs, and heavy metals.

- Food poisoning from beef: use *Gan Cao* alone as decoction.
- Drug poisoning: use *Gan Cao* with honey.
- Herbicide or pesticide poisoning: use 12 grams of *Gan Cao* and 15 grams of *Hua Shi* (Talcum) in herbal decoction, three times daily.
- Lead poisoning: use this herb with *Xing Ren* (Semen Armeniacae Amarum).
- Arsenic poisoning: use it with *Lu Dou* (Semen Phaseoli Radiati), *Hei Dou* (Semen Glycine Max) and *Jin Yin Hua* (Flos Lonicerae).

### 6. Harmonizes Other Herbs

*Gan Cao* harmonizes and moderates the harsh or adverse effects of other herbs, keeping them from damaging the middle *jiao*.

- It neutralizes the toxicity of *Fu Zi* (Radix Aconiti Lateralis Praeparata).
- *Gan Cao* controls the warm property of *Gan Jiang* (Rhizoma Zingiberis) to prevent damage to the yin.
- It prevents the cold properties of *Shi Gao* (Gypsum

# Gan Cao (Radix Glycyrrhizae)

Fibrosus) and *Zhi Mu* (Radix Anemarrhenae) from damaging the Stomach.

- This herb reduces the initial drastic and potent purgative effects of *Da Huang* (Radix et Rhizoma Rhei) and *Mang Xiao* (Natrii Sulfas), and prolongs the overall duration of effect.
- It reduces the initial peak in effect of *Dang Shen* (Radix Codonopsis), *Bai Zhu* (Rhizoma Atractylodis Macrocephalae), *Shu Di Huang* (Radix Rehmanniae Preparata) and *Dang Gui* (Radix Angelicae Sinensis) and prolongs the overall tonic effect.
- *Gan Cao* is used with both cold and hot herbs such as *Ban Xia* (Rhizoma Pinelliae), *Gan Jiang* (Rhizoma Zingiberis), *Huang Lian* (Rhizoma Coptidis) and *Huang Qin* (Radix Scutellariae), to harmonize the effect of the overall combination.

## DOSAGE

3 to 10 grams, with a maximum of 15 to 30 grams. *Gan Cao* is used in herbal decoction, powder, pills or syrup. It is commonly used both internally and topically. The unprocessed herb more strongly purges fire, eliminates toxins, moistens the Lung, and stops cough; therefore, it is commonly used to treat throat soreness and pain, various infections with formation of pus and abscess, cough with hot phlegm, and food or drug poisoning. Honey-processed *Gan Cao* has a sweeter taste and warmer nature; therefore, it tonifies the Spleen, benefits qi, moistens the Lung, and stops cough. The honey-fried herb is stronger than the unprocessed herb for tonification of qi.

## CAUTIONS / CONTRAINDICATIONS

- Sweet in nature, *Gan Cao* can create dampness and is, therefore, contraindicated in cases of nausea, vomiting, chest and abdominal fullness and distention due to accumulation of dampness.
- *Gan Cao* is incompatible with *Gan Sui* (Radix Euphorbiae Kansui), *Da Ji* (Radix Euphorbiae seu Knoxiae), *Yuan Hua* (Flos Genkwa), and *Hai Zao* (Sargassum).
- Large dosages or chronic usage of *Gan Cao* are contraindicated in cases of edema, kidney disorders, hypokalemia, hypertension, and congestive heart failure.

## OVERDOSAGE

Overdose or chronic use of *Gan Cao* may cause edema, elevated blood pressure, weak extremities, numbness, sodium retention, potassium loss, dizziness, and headache.

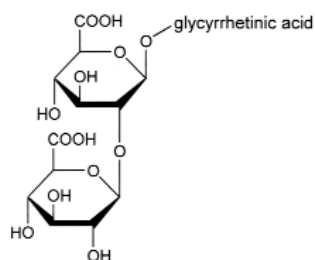
## TREATMENT OF OVERDOSAGE

*Ze Xie* (Rhizoma Alismatis) and *Fu Ling* (Poria) should be combined with *Gan Cao* to prevent sodium and water

retention, especially if *Gan Cao* is to be used in a large dose or on a long-term basis. Reduction of sodium intake and supplementation of potassium are also recommended. Discontinue *Gan Cao* should the patient report edema, elevated blood pressure, or other adverse reactions.

## CHEMICAL COMPOSITION

Triterpenoids (glycyrrhizin, glycyrrhizic acid, glycyrrhetic acid, glycyrrhetic acid), flavonoids (liquiritin, isoliquiritin, liquiritigenin, uralenol-3-methylether, uralene).<sup>1,2</sup>



Glycyrrhizic Acid

## PHARMACOLOGICAL EFFECTS

- **Mineralocorticoid:** Extract of *Gan Cao* or its compounds (glycyrrhizin and glycyrrhetic acid) have all demonstrated mineralocorticoid effects, leading to increased re-absorption of sodium and water and excretion of potassium. Overdose or long-term ingestion may cause an increase in edema and blood pressure.<sup>3</sup>
- **Glucocorticoid:** Administration of glycyrrhizin and glycyrrhetic acid clearly enhances the overall duration of effect of cortisone, as demonstrated by various laboratory studies. The proposed mechanisms of action vary among experts. Some believe that the enhanced cortisone effect is due to decreased metabolism by the liver, or increased plasma concentration caused by decreased protein binding.<sup>4</sup>
- **Anti-inflammatory:** Glycyrrhizin and glycyrrhetic acid have demonstrated marked anti-inflammatory effects. Clinical applications include inflammation, edema, formation of granuloma, arthritis, and others. The proposed mechanism of anti-inflammatory action includes decreased permeability of the blood vessels, antihistamine functions, and decreased sensitivity to stimuli. The anti-inflammatory influence of glycyrrhizin and glycyrrhetic acid is approximately 1/10<sup>th</sup> that of cortisone.<sup>5</sup>
- **Antiarrhythmic:** Extract of *Zhi Gan Cao* (Radix Glycyrrhizae Preparata) has shown marked effectiveness in treating arrhythmia induced by aconitine in rabbits.<sup>6</sup>
- **Immunologic:** Administration of *Gan Cao* may stimulate or inhibit the phagocytic activity of macrophages in

## Gan Cao (Radix Glycyrrhizae)

mice. Under a stressful environment (cold, heat or hunger), the herb stimulates the immune system and increases phagocytic activities. In a normal environment, *Gan Cao* inhibits the immune system.<sup>7</sup>

- **Gastrointestinal:** Many components of *Gan Cao* have proven to prevent and treat peptic ulcers. The mechanisms of this action include inhibition of gastric acid secretion, binding and deactivation of gastric acid, and promotion of recovery from ulceration.<sup>8</sup>
- **Antispasmodic:** Both water and alcohol extracts of *Gan Cao* exert inhibitory influences on smooth muscle to stop spasms and cramps of the intestines and uterus. The antispasmodic effect is enhanced when *Bai Shao* (Radix Paeoniae Alba) is added.<sup>9</sup>
- **Antitoxin:** Glycyrrhizin, generally considered to be one of the main constituents of *Gan Cao*, has a marked detoxifying effect to treat poisoning, including but not limited to drug poisoning (chloral hydrate, urethane, cocaine, picrotoxin, caffeine, pilocarpine, nicotine, barbiturates, mercury and lead), food poisoning (tetrodotoxin, snake and mushrooms), and others (enterotoxin, herbicides and pesticides). On the other hand, *Gan Cao* is not effective in treating poisoning caused by atropine, morphine, and sulfonmethane. It may increase the toxicity of ephedrine. The exact mechanism of this action is unclear, but is thought to be related to its regulatory effect on the endocrine or hepatic systems. Oral ingestion of *Gan Cao* reduces the absorption of toxins via direct binding, an effect similar to that of activated charcoal. *Gan Cao* significantly reduces the toxicity of *Fu Zi* (Radix Aconiti Lateralis Praeparata) when the two herbs are decocted together.<sup>10,11</sup>
- **Hepatoprotective:** Studies in mice have shown that *Gan Cao* increases the amount of cytochrome p-450 in the liver, which is responsible for the protective effect of the herb on the liver against chemical or tetrachloride-induced liver damage and liver cancer.<sup>12</sup>
- **Antitussive and expectorant:** Administration of *Gan Cao* is associated with marked antitussive and expectorant effects in guinea pigs. The antitussive effect is thought to be related to its effect on the central nervous system.<sup>13</sup>
- **Analgesic:** *Gan Cao* has an analgesic effect as demonstrated by studies in mice. The analgesic effect of *Gan Cao* is enhanced by concurrent use of *Bai Shao* (Radix Paeoniae Alba).<sup>14</sup>
- **Antibiotic:** *Gan Cao* inhibits the growth of *Staphylococcus aureus*, *Mycobacterium tuberculosis*, *E. coli*, amoebae and *Trichomonas vaginalis*.<sup>15</sup>
- **Antihyperlipidemic:** While glycyrrhizin has been shown to lower plasma cholesterol levels, *Gan Cao* has not demonstrated any preventative or treatment effect on atherosclerosis.<sup>16</sup>

### CLINICAL STUDIES AND RESEARCH

- **Endocrine:** In one study, 8 out of 9 patients with declining pituitary function were treated successfully by 2 to 3 months of taking the following herbal combination: 15 to 30 grams of fresh *Gan Cao* and 6 grams of *Ren Shen* (Radix Ginseng). Modifications to the herbal formula were made if deemed necessary. For severe aversion to cold, 10 grams of *Fu Zi* (Radix Aconiti Lateralis Praeparata) were added. The duration of treatment was increased to 2 to 6 months. If elevated blood pressure and edema were noted, the dosage of *Gan Cao* was reduced by 50% and 10 grams each of *Fu Ling* (Poria), *Du Zhong* (Cortex Eucommiae) and *Wu Wei Zi* (Fructus Schisandriae Chinensis) were added.<sup>17</sup>
- **Addison's disease:** Extract of *Gan Cao* given three times daily for 25 to 40 days showed marked effectiveness in treating patients with Addison's disease. Patients with mild to moderate conditions required only 3 to 5 ml of the herb per dose. Patients with more severe conditions required up to 8 to 10 ml of the herb per dose, and supplements of adrenocortical steroids if necessary.<sup>18</sup>
- **Peptic ulcer:** One hundred patients with gastric or duodenal ulcers were treated with 15 ml of *Gan Cao* extract, four times daily for 6 weeks, with 90% rate of effectiveness.<sup>19</sup>
- **Tuberculosis:** In one study, 55 patients with pulmonary tuberculosis were treated with an herbal decoction three times daily for 30 to 90 days. There was significant improvement in 23 patients and some improvement in 32 patients. The main ingredient of the herbal formula was 18 grams of fresh *Gan Cao*, cooked to yield 150 ml of the decoction. Other herbs effective in treating tuberculosis were added based on the condition of each patient.<sup>20</sup>
- **Hepatitis:** Hepatitis B in 330 patients was treated with glycyrrhizin, with 77% effectiveness. The study reported that glycyrrhizin reduced the damage to and death of liver cells, reduced inflammatory reaction, promoted regeneration of liver cells, and decreased the risk of liver cirrhosis and necrosis.<sup>21</sup>
- **Arrhythmia:** An herbal decoction administered twice daily for 3 to 12 doses had satisfactory results in treating 23 patients with arrhythmia. The study reported that the patients had no subjective complaints and ECGs appeared normal. The herbal formula contained 30 grams each of *Gan Cao*, *Zhi Gan Cao* (Radix Glycyrrhizae Preparata), and *Ze Xie* (Rhizoma Alismatis).<sup>22</sup>
- **Back and leg pain:** According to one report, 27 patients with severe pain of the back and legs were treated by local injection of a *Gan Cao* solution, with complete relief of pain in 20 patients and moderate relief in 7 patients. Patients with acute conditions received injections every other day for 4 to 7 treatments; those with chronic conditions received injections every other day, for 8 to 14 treatments.<sup>23</sup>

## Gan Cao (Radix Glycyrrhizae)

- **Purpura:** Eight patients with purpura caused by thrombocytopenia were treated with decoction of *Gan Cao* (25 to 30 grams), three times daily, with significant improvement in 3 patients, moderate improvement in 4 patients and some improvement in 1 patient. The study reported that bleeding stopped for most patients within 3 to 4 days.<sup>24</sup>
- **Intestinal spasms:** In one study, 241 out of 254 patients (94.8%) with intestinal spasms showed significant improvement after receiving 10 to 15 ml of extract of *Gan Cao* three times daily for 3 to 6 days.<sup>25</sup>
- **Food poisoning:** Administration of a decoction of *Gan Cao* was used to treat 454 patients with various kinds of food poisoning, with satisfactory results in most cases. The treatment protocol for mild cases of food poisoning was to use 9 to 15 grams of *Gan Cao* in herbal decoction, given in 3 to 4 equally-divided doses over 2 hours. In severe cases, 30 grams of the herb were cooked in water to yield 300 ml of herbal decoction, given in 3 equally-divided doses, every 3 to 4 hours.<sup>26</sup>
- **Mushroom poisoning:** Another report describes 20 out of 22 patients with mushroom poisoning who had complete recovery, after being treated with an herbal decoction of *Gan Cao*. Two patients required hospitalization because immediate herbal treatment was not available. The herbal decoction was prepared by using 94 grams of *Gan Cao* cooked twice to yield 200 ml of final decoction. Patients were given 100 ml of the decoction immediately, followed by another 100 ml 30 minutes later.<sup>27</sup>
- **Profuse urination:** Two patients with profuse urination were treated with 5 grams of powdered *Gan Cao* four times daily with good results.<sup>28</sup>
- **Tonsillitis:** In one study, 34 out of 38 patients reported complete recovery from chronic tonsillitis after being treated with *Gan Cao* tea for 1 to 5 months. The treatment protocol was to soak 10 grams of the herb in hot water and drink throughout the day as tea. Patients were advised to avoid fish and spicy or sweet foods. Patients with mild conditions required 1 to 2 months of treatment, while those with severe conditions required 3 to 5 months.<sup>29</sup>
- **Phlebitis:** Three patients with phlebitis were treated with marked effectiveness using 15 ml of extract or 50 grams of *Gan Cao* in decoction three times daily, before meals. The study reported relief of pain, edema and other symptoms after herbal treatment.<sup>30</sup>
- **Acute mastitis:** According to one report, 27 patients with acute mastitis (without suppuration) were treated with satisfactory results using an herbal decoction containing 30 grams each of *Gan Cao* and *Chi Shao* (Radix Paeoniae Rubrae), given one time daily for 1 to 3 days.<sup>31</sup>
- **Frostbite:** Complete recovery from frostbite was reported in 58 out of 76 patients after being treated with an herbal solution applied topically three times daily. The

herbal solution was prepared by cooking 10 grams each of *Gan Cao* and *Yuan Hua* (Flos Genkwa), to yield 2,000 ml of the herbal solution.<sup>32</sup>

### HERB-DRUG INTERACTION

- **Corticosteroids:** It has been suggested that the use of *Gan Cao* may alter the therapeutic effects of systemic corticosteroids. Glycyrrhizin, one of the components of *Gan Cao*, is a strong inhibitor of 11  $\beta$ -hydroxysteroid dehydrogenase and may prolong the biological half-life of the systemic corticosteroids.<sup>33</sup> [Note: Examples of corticosteroids include cortisone, prednisone (Orasone), dexamethasone (Decadron), hydrocortisone (Cortef), methylprednisolone (Medrol).]
- **Digoxin:** *Gan Cao* should be used with caution with cardiac glycosides, such as digoxin (Lanoxin), as potassium loss may increase the toxicity of the drug.<sup>34</sup>
- **Drug overdose:** *Gan Cao* speeds the metabolism of drugs such as chloral hydrate, urethane, cocaine, picrotoxin, caffeine, pilocarpine, nicotine, and barbiturates, and treats overdose of these agents.<sup>35</sup>

### TOXICOLOGY

Administration of decoction of *Gan Cao* in mice at the dosage of 2 g/kg for 6 weeks resulted in no fatalities or signs of edema. In another study, an increase in body weight and decrease in function of the adrenal glands were associated with continuous administration of *Gan Cao* extract for 40 days in rabbits and guinea pigs.<sup>36,37</sup>

Glycyrrhetic acid is associated with a reduction of thyroid function and a decrease in the basal metabolic rate in guinea pigs.<sup>38</sup>

The LD<sub>50</sub> for water extract of *Gan Cao* in mice is 1.9432 +/- 0.467 g/kg via intravenous injection, 6.8466 g/kg via intraperitoneal injection, and 7.8192 g/kg via subcutaneous injection.<sup>39</sup>

### SUPPLEMENT

- 炙甘草 / 炙甘草 *Zhi Gan Cao* (Radix Glycyrrhizae Preparata), sweet and warm, is the honey-processed form of *Gan Cao*. *Zhi Gan Cao* has a stronger effect than *Gan Cao* to tonify Spleen, benefit qi, moisten the Lung, and stop cough.

### AUTHORS' COMMENTS

According to traditional texts, *Gan Cao* is incompatible with *Hai Zao* (Sargassum). However, throughout the history of Chinese medicine, there have been several formulas that incorporate both herbs, such as *Hai Zao Yu Hu Tang* (Sargassum Decoction for the Jade Flask). According to Jiang Te-Xie's article "*Hai Zao* is not incompatible with *Gan Cao*," 10 grams of *Gan Cao* with 15 grams of *Hai Zao*

# Gan Cao (Radix Glycyrrhizae)

(when cooked in a decoction and administered to patients) did not present any adverse reactions.<sup>40</sup>

According to Dr. Zhang Xue-Wen, *Gan Cao*, *Lu Dou* (Semen Phaseoli Radiati), and *Bai Mao Gen* (Rhizoma Imperatae) are effective to treat food poisoning. *Gan Cao* and *Lu Dou* clear heat and toxins, and are commonly used to eliminate toxicity from herbs, drugs and food. *Bai Mao Gen* clears heat and promotes diuresis to quickly dispel toxins from the body, prevent internal bleeding, and protect the kidneys.

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