

Ma Huang (Herba Ephedrae)



麻黄

Pinyin Name: *Ma Huang*

Literal Name: “hemp yellow,” “numb yellow herb”

Alternate Chinese Names: *Jing Ma Huang*, *Ma Huang Rong*

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

English Name: ephedra

Botanical Name: *Ephedra sinica* Stapf. (*Mu Cao Ma Huang*); *Ephedra equisetina* Bunge. (*Mu Zei Ma Huang*)

Pharmaceutical Name: Herba Ephedrae

Properties: acrid, bitter, warm

Channels Entered: Lung, Urinary Bladder

CHINESE THERAPEUTIC ACTIONS

1. Releases the Exterior through Diaphoresis

Exterior-excess, wind-cold condition: Acrid and warm, *Ma Huang* (Herba Ephedrae) ventilates the Lung and is commonly used to treat exterior-excess, wind-cold syndrome characterized by symptoms such as chills, aversion to cold, fever, absence of perspiration, headache, body aches and pain, nasal obstruction, and a superficial, tight pulse. Its dispersing function also opens peripheral channels and collaterals.

- Exterior-excess, wind-cold syndrome: use it with *Gui Zhi* (Ramulus Cinnamomi) to enhance the diaphoretic action. **Exemplar Formula:** *Ma Huang Tang* (Ephedra Decoction).

2. Relieves Wheezing and Dyspnea, Stops Cough

Wind-cold constriction of the Lung leading to Lung qi reversal: *Ma Huang* ventilates Lung qi and is useful in treatment of wheezing, dyspnea and cough characterized by wind-cold attacking the exterior that leads to abnormal rising of Lung qi.

- Cough from wind-cold attacking the exterior and constricting Lung qi: use it with *Xing Ren* (Semen Armeniacae Amarum). *Ma Huang* and *Xing Ren* work synergistically to treat cough, as the former herb disperses Lung qi and relieves stagnation while the latter herb sends qi downward.
- Wheezing or cough caused by Lung heat: combine it with *Shi Gao* (Gypsum Fibrosum) and *Xing Ren* (Semen Armeniacae Amarum). *Ma Huang* and *Xing Ren* have synergistic functions in treating wheezing and dyspnea. *Shi Gao* clears Lung heat and neutralizes the warm property of *Ma Huang* to prevent the possible side effect of

excess perspiration. **Exemplar Formula:** *Ma Xing Gan Shi Tang* (Ephedra, Apricot Kernel, Licorice, and Gypsum Decoction).

- Wheezing or cough from wind-cold attack at the exterior and cold stagnation in the interior: add it to *Gan Jiang* (Rhizoma Zingiberis), *Xi Xin* (Herba Asari) and *Ban Xia* (Rhizoma Pinelliae). **Exemplar Formula:** *Xiao Qing Long Tang* (Minor Bluegreen Dragon Decoction).
- Wheezing and dyspnea caused by stagnation of qi and phlegm: combine it with *Xing Ren* (Semen Armeniacae Amarum), *Chen Pi* (Pericarpium Citri Reticulatae) and *Hou Po* (Cortex Magnoliae Officinalis). **Exemplar Formula:** *Shen Mi Tang* (Mysterious Decoction).

3. Regulates Water Circulation and Relieves Edema

Edema with exterior syndrome: *Ma Huang* enters the Lung and Urinary Bladder channels to regulate water circulation and eliminate edema. Excess water is generally eliminated through perspiration, increased urination, or both.

- Edema with exterior wind-cold signs or symptoms: use *Ma Huang* with *Sheng Jiang* (Rhizoma Zingiberis Recens), *Bai Zhu* (Rhizoma Atractylodis Macrocephalae) and *Gan Cao* (Radix Glycyrrhizae) to dispel the exterior condition and eliminate water accumulation. **Exemplar Formula:** *Yue Bi Jia Zhu Tang* (Maid-servant from Yue Decoction plus Atractylodes).

4. Disperses Cold

Bi zheng (painful obstruction syndrome): Warm and dispersing in nature, *Ma Huang* disperses and eliminates cold and damp from the exterior parts of the body.

- *Bi zheng* caused by wind-damp: use it with *Yi Yi Ren*

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(Semen Coicis), *Xing Ren* (Semen Armeniacae Amarum) and *Gan Cao* (Radix Glycyrrhizae) to treat muscle aches and pain of the extremities caused by wind-damp.

Yin sores: This condition is characterized by localized, painful swellings without heads, that blend into the surrounding tissues. They often appear to be the same color as the skin and are not hot to the touch. The underlying cause of this problem is blood deficiency with stagnation of cold and phlegm.

- **Yin sores:** use *Ma Huang* with *Shu Di Huang* (Radix Rehmanniae Preparata), *Bai Jie Zi* (Semen Sinapis) or *Lu Jiao Jiao* (Gelatinum Cornu Cervi).
- **Arteritis obliterans, obliterating phlebitis or Raynaud's disease:** use it with *Shu Di Huang* (Radix Rehmanniae Preparata), *Bai Jie Zi* (Semen Sinapis), *Lu Jiao Jiao* (Gelatinum Cornu Cervi), *Rou Gui* (Cortex Cinnamomi) and *Gan Cao* (Radix Glycyrrhizae).

DOSAGE

1.5 to 10 grams in decoction. The maximum dosage of *Ma Huang* is 20 to 25 grams. Use of *Ma Huang* in treating edema requires dosage between 10 and 15 grams.

The proper method for preparing *Ma Huang* is to pre-decoct it and remove the resultant foam from the solution prior to the addition of other herbs. Classic texts state that the foam is the component more likely to cause irritability. To minimize diaphoresis and neutralize the warm nature of *Ma Huang*, *Shi Gao* (Gypsum Fibrosum) is frequently used with *Ma Huang* in a three-to-one ratio (*Shi Gao* 3 : *Ma Huang* 1).

Different types of *Ma Huang* have slightly different therapeutic functions: unprocessed *Ma Huang* has a stronger function to induce perspiration and is commonly used to treat wind-cold conditions; honey-fried *Ma Huang* is weaker in inducing perspiration but more strongly moistens the Lung and relieves wheezing, dyspnea and cough; and crushed *Ma Huang Rong* is milder in inducing perspiration and is generally used in pediatric medicine to relieve exterior syndromes.

CAUTIONS / CONTRAINDICATIONS

- Because *Ma Huang* strongly functions to induce diaphoresis and ventilate the lungs, inappropriate use may damage qi, yin and body fluids. It should be used with caution in patients with weak constitutions, spontaneous perspiration arising from qi deficiency, night perspiration due to yin deficiency, wheezing or dyspnea caused by Kidney deficiency (manifesting in long exhalation and short inhalation), or edema due to Spleen deficiency.
- Chronic or repetitive use of *Ma Huang* to treat wheezing/dyspnea is not recommended, as it may damage

Lung qi and lead to further complications. Other herbs must be added to harmonize its strong effects.

- Ingesting *Ma Huang* is not recommended in patients with Liver yang rising or yin-deficient fire, as its use may lead to vertigo, epistaxis, or hematemesis.
- *Ma Huang* has a stimulating effect on the sympathetic nervous system. Thus, it should be used with caution in patients with such medical conditions as convulsions, epilepsy and seizure disorders, diabetes mellitus, hypertension, hyperthyroidism and prostatic enlargement.
- Use *Ma Huang* with caution during pregnancy because of its stimulating effect on the uterus.¹

OVERDOSAGE

Overdose of *Ma Huang* is characterized by stimulation of the sympathetic nervous system by the numerous ephedrine alkaloids in the herb. Symptoms include excitation, irritability, restlessness, hypersensitivity, tinnitus, insomnia, nausea, vomiting, red face, upper abdominal discomfort, poor appetite, thirst, perspiration, increased blood pressure, dizziness, elevated blood glucose levels, chest pain, and tremor. In severe cases, there may be cardiac arrhythmia, increased blood pressure, and possibly epilepsy and convulsions. Adverse reactions generally occur between one-half and two hours following ingestion of an excessive quantity of the herb.²

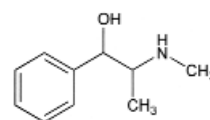
TREATMENT OF OVERDOSAGE

Overdose of *Ma Huang* may be treated with either of two herbal formulas:

- Formula one contains *Da Huang* (Radix et Rhizoma Rhei) 9g, *Hou Po* (Cortex Magnoliae Officinalis) 9g, *Mu Xiang* (Radix Aucklandiae) 9g, *Mang Xiao* (Natrii Sulfas) 15g, and *Gan Cao* (Radix Glycyrrhizae) 6g. The decoction is to be taken once every four hours until toxic symptoms are alleviated.
- Formula two contains *Lu Dou* (Semen Phaseoli Radiati) 15g and *Gan Cao* (Radix Glycyrrhizae) 30g cooked in water to yield 300 ml of decoction. Patients are instructed to take 150 ml per dose, every two hours, for 3 to 5 doses.^{2,3}

CHEMICAL COMPOSITION

Ephedrine alkaloids 0.481-2.47% (l-ephedrine, d-pseudoephedrine, l-norephedrine, d-norpseudoephedrine, l-methylephedrine, d-methylpseudoephedrine), ephedroxane, 2,3,4-trimethyl-5-phenyloxazolidine benzylmethylamine, 2,3,5,6-tetramethylpyrazine, essential oil 0.25% (l- α -terpineol).^{4,5}



Ephedrine

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PHARMACOLOGICAL EFFECTS

- **Diaphoresis:** In humans, administration of ephedrine alkaloids is associated with increased perspiration, but only in subjects with elevated body temperature.⁶
- **Antipyretic:** Essential oil of *Ma Huang* is associated with antipyretic action in rabbits with artificially-induced fever. It also reduces temperature in mice with normal body temperature. However, it has no effect on cats with normal body temperature.⁷
- **Respiratory:** Both ephedrine and pseudoephedrine have mild, prolonged bronchodilating effects. Ephedrine has a more rapid onset of action, but its effectiveness may decrease if it is used repeatedly in a short period of time.⁸ Water extract of *Ma Huang* administered via oral or intraperitoneal injection is also associated with an anti-tussive effect.⁹
- **Diuresis:** Pseudoephedrine has a diuretic function.¹⁰
- **Cardiovascular:** Use of *Ma Huang* is associated with an increase in both systolic and diastolic blood pressures. Ephedrine has a mild but prolonged effect to constrict blood vessels and raise blood pressure.¹¹
- **CNS stimulant:** Ephedrine has a marked stimulating influence on the central nervous system (CNS), cardiovascular system, and respiratory system. It may cause such side effects as irritability, insomnia, restlessness and tremor.^{12,13}
- **Antibiotic:** Decoction of *Ma Huang* has varying degrees of inhibitory effect *in vitro* against *Staphylococcus aureus*, α -streptococcus, β -streptococcus, *Bacillus anthracis*, *Corynebacterium diphtheriae*, *Pseudomonas aeruginosa*, *Bacillus dysenteriae*, and *Salmonella typhi*.¹⁴ The essential oil of *Ma Huang* has an inhibitory effect against *E. coli*, *Candida albicans*, and various types of influenza virus.¹⁵

CLINICAL STUDIES AND RESEARCH

- **Infantile diarrhea:** According to one report, 138 patients with infantile diarrhea were treated with *Ma Huang* (2 to 4 grams) and *Qian Hu* (*Radix Peucedani*) (4 to 8 grams). The herbs were given once daily as an herbal decoction with the addition of a small amount of sugar. Out of 138 patients, 126 (91.3%) showed significant improvement, and 124 (90%) responded within 1 to 2 doses. This study demonstrates the *zang fu* relationship between the Lung and Large Intestine, in that ventilation of the Lung helps with water retention of the Large Intestine.¹⁶
- **Coughing and wheezing:** In a clinical trial, 260 patients with coughing, wheezing and asthma from various causes were treated with Chinese herbal formulas, with complete recovery in 148 patients, marked improvement in 107 patients, and no response in 5 patients. The formulas were given as decoctions, six to eight times daily for children, and three times daily for adults. The funda-

mental formula included *Ma Huang* 10g, *Pi Pa Ye* (*Folium Eriobotryae*) 10g, *Zi Wan* (*Radix Asteris*) 15g, *Kuan Dong Hua* (*Flos Farfarae*) 15g, *Bai Qian* (*Rhizoma Cynanchi Stauntonii*) 15g, *Sang Bai Pi* (*Cortex Mori*) 15g, *Ting Li Zi* (*Semen Descurainiae seu Lepidii*) 10g, *Bai Jie Zi* (*Semen Sinapis*) 10g, *Su Zi* (*Fructus Perillae*) 10g, *Lai Fu Zi* (*Semen Raphani*) 10g, *Wu Wei Zi* (*Fructus Schisandrae Chinensis*) 10g, *Tu Si Zi* (*Semen Cuscutae*) 10g, *Bei Mu* (*Bulbus Fritillaria*) 10g, *Ban Xia* (*Rhizoma Pinelliae*) 10g, *Chen Pi* (*Pericarpium Citri Reticulatae*) 10g, *Xing Ren* (*Semen Armeniacae Amarum*) 15g, and *Jie Geng* (*Radix Platycodonis*) 15g. Modifications to the fundamental formula included *Gan Jiang* (*Rhizoma Zingiberis*) for cold; *Huang Qin* (*Radix Scutellariae*) and *Huang Lian* (*Rhizoma Coptidis*) for heat; *Dang Shen* (*Radix Codonopsis*) and *Huang Qi* (*Radix Astragali*) for deficiency; and *Da Huang* (*Radix et Rhizoma Rhei*) and *Mang Xiao* (*Natrii Sulfas*) for excess.¹⁷

- **Asthma:** An herbal formula containing *Ma Huang*, *Di Long* (*Pheretima*), *Chuan Bei Mu* (*Bulbus Fritillariae Cirrhosae*), *Chan Tui* (*Periostracum Cicadae*) and *Gan Cao* (*Radix Glycyrrhizae*) was used to treat asthma patients. Minor modifications to the formula were made, depending on the condition of each individual patient, if deemed necessary by the doctors. Out of 55 patients, 28 showed marked improvement, 15 showed moderate improvement, and 2 showed no response.¹⁸

HERB-DRUG INTERACTION

- **General effect:** *Ma Huang* contains ephedrine alkaloids that stimulate the central nervous system and the cardiovascular system. Combining *Ma Huang* with cardiac glycosides may lead to cardiac arrhythmia. *Ma Huang* should not be combined with other sympathomimetic drugs, such as ephedrine, pseudoephedrine, theophylline, caffeine, monoamine oxidase inhibitors (MAOI), or substances with similar properties.¹⁹
- **Beta blockers:** The effect of beta blockers may be reduced when combined with *Ma Huang* because of increased levels of norepinephrine caused by the herb.²⁰ [Note: Examples of beta blockers include atenolol (Tenormin), metoprolol (Lopressor/Toprol), sotalol (Betapace), propranolol (Inderal), and labetalol (Normodyne/Trandate).]
- **Diuretics:** *Ma Huang* has a diuretic effect. Though this potential interaction has not been documented, concurrent use with diuretic drugs may lead to increased elimination of water and/or electrolytes.²¹ [Note: Examples of diuretics include chlorothiazide, hydrochlorothiazide, furosemide (Lasix), bumetanide (Bumex), and torsemide (Demadex).]

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TOXICOLOGY

Ephedrine and pseudoephedrine are well-absorbed. Peak plasma concentration is reached 1 to 2 hours after oral ingestion of the herb. Ephedrine and pseudoephedrine are distributed throughout the body, with higher concentrations found in the liver and kidneys, followed by the brain, spleen, fatty tissues, and saliva. The half-lives of these compounds range from 4.73 to 7.1 or 13.4 hours (when the urinary pH is 5.2, 6, and 7, respectively). Up to 75% of these compounds can be recovered unchanged in the urine.⁴

The LD₅₀ for water-extracted *Ma Huang* in mice via intraperitoneal injection is 650 mg/kg. The LD₅₀ for essential oil of *Ma Huang* in mice is 1.35 ml/kg via intraperitoneal injection, and 2.79 ml/kg via oral ingestion.²²

AUTHORS' COMMENTS

Ma Huang is one of the most extensively studied Chinese herbs. Several ephedrine alkaloids, such as ephedrine and pseudoephedrine, have been isolated and used as pharmaceutical drugs. Though the herb is not as potent as its drug counterpart, the herb still possesses strong medicinal properties and stimulates both the central nervous system and the cardiovascular system.

Ma Huang must be prescribed carefully and its use supervised. Respectful attention to dosages and the clear guidelines for use of this herb will result in safe applications in the majority of cases. Inappropriate or prolonged use, or high dosages, may lead to adverse reactions and unwanted side effects. While taking this herb, patient symptoms and progress must be closely monitored, as adverse reactions and side effects may occur in individuals with pre-existing medical conditions.

Traditionally, *Ma Huang* is pre-decocted and the resultant foam removed, prior to addition of the other herbs. Various sources offer several reasons for this. Some indicate that the foam may cause irritability. Others state that the foam is representative of the diaphoretic function of *Ma Huang* and is strongest in inducing perspiration. Therefore, the foam is best removed to prevent irritability and excessive diaphoresis.

Patients with initial wind-cold invasion may require the use of unprocessed *Ma Huang*, as it is strongest in inducing perspiration and driving out external pathogenic factors lingering in the *wei* (defense) level. However, if the patient has overcome the exterior condition but still is experiencing coughing, dyspnea or wheezing, then it is best to choose honey-fried *Ma Huang*, as it has a weaker diaphoretic function but is stronger to relieve rebellious

Lung qi. Honey-fried *Ma Huang* should be used instead of unprocessed *Ma Huang* when treating respiratory disorders not caused by exterior wind-cold invasion manifesting in cough, dyspnea or wheezing.

According to the clinical experience of Dr. Chen Shu-Sheng, *Ma Huang* constricts blood vessels and should be used with caution for hypertensive patients. The strong diaphoretic effect contraindicates its use for weak patients or those experiencing excessive sweating. However, *Ma Huang Gen* (*Radix Ephedrae*) has the exact opposite effect. It dilates the blood vessels to lower blood pressure and consolidates the *wei* (defensive) level and stops perspiration. When used together, the herb and root regulate respiration and increase the physiological efficiency of the lung without causing the side effects of hyperactivity or increased blood pressure.

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