# Astragalus

***Astragalus membranaceus***

## Common names

Milkvetch root, Mongolian milkvetch, huang qi

## Family

*Fabaceae* (legume)

## Part used

Root

## Background and traditional uses

Astragalus, also known as radix astragali or huang qi, the latter translating to 'yellow leader', is a perennial plant with a yellow cylindrical root.[1,2]

Used extensively in traditional Chinese medicine (TCM), astragalus is indigenous to China, Korea, Mongolia and Russia and is considered to have sweet and slightly warm properties.[1,3,4]

Astragalus root has been used therapeutically for many centuries, with the original report of its use recorded in the Chinese herbal classic, Shen Nong Ben Cao Jing (Divine Husbandman's Classic of the Materia Medica) in the second century.[4,5]

Considered to be an important TCM tonic herb for enhancing immunity, astragalus tonifies qi and increases yang energy. It has been used individually and in combination with other herbs to treat qi deficiency and its associated symptoms including fatigue, weakness, poor appetite, diarrhoea and frequent respiratory infections or colds.[2-6]

Additionally, astragalus has been used traditionally for its diuretic properties in the treatment of such conditions as spontaneous sweating, oedema, postpartum fever, uterine retention, wound healing, organ prolapse, heavy blood loss and diabetes.[1,3-5,7]

## Actions

**Primary:**[3,8]

- Immune enhancing
- Immune modulating
- Adaptogen
- Anti-inflammatory
- Antioxidant

**Secondary:**[3,8]

- Antiviral
- Anticarcinogenic
- Antidiabetic
- Cardioprotective
- Hepatoprotective
- Vulnerary
- Diuretic
- Nutritive for bone building

## Applications and indications

- Common cold, upper respiratory infections, allergic rhinitis, and to strengthen and regulate the immune system.[3,9,10]
- Athletic performance and reducing exercise-induced fatigue.[3,11-13]
- Antiviral activity against Epstein-Barr virus (EBV), hepatitis B and herpes simplex virus (HSV)-1.[14-17]
- Conditions requiring diuresis.[18]

# Active constituents and pharmacodynamics

The primary chemical constituents present in the root of astragalus that contribute to the herbs pharmacological effects are polysaccharides, saponins and flavonoids.[1,2,19]

The main **polysaccharide** constituents are astragalans I, II and III.[1,7] These constituents exhibit a range of pharmacological effects including immune stimulating, anti-inflammatory, antioxidant, hepatoprotective, antiasthmatic, antidiabetic[24], antitumour and cardioprotective activity.[1,7,20-28]

**Triterpene saponins** are also present with the most therapeutically relevant being the astragalosides I-VIII.[1,2,7] Specifically, astragaloside IV is considered to be a significant active constituent, and is associated with immune stimulating, hepatoprotective, cardioprotective, antiproliferative, antiasthmatic, anti-inflammatory, antioxidant and CNS-protective effects.[2,19,29,30-32]

The main **flavonoid** constituents are flavones, isoflavones, pterocarpans and chalcones.[2,7] Pharmacological activity associated with flavonoids include anti-inflammatory, antiproliferative, immunomodulatory and antioxidant effects.[2,6,7,21]

# Summary of clinical evidence

### Immune modulation

Human, animal and *in vitro* evidence has demonstrated the effect of astragalus on immune activity. In a small study, four subjects were sublingually administered three different doses of astragalus on in a three-arm design separated by four week washout periods, with the physiological response to the herb assessed over the subsequent 24-hour period.[10] The doses of astragalus (1:5) were 0.25, 0.75 and 1.5mL per kg, equivalent to a dose of 3.3,10 and 20g of dried root respectively.

Physiological assessments included white blood cell populations (total WBC, lymphocytes, monocytes, neutrophils, platelets), lymphocyte subpopulations (total T-cells, T-helper cells, T-cytotoxic cells, B-cells and NK cells), and cytokine assay (IL-1 beta, IL-2, sIL-2R, IFN-gamma, IL-5-8, IL-10, IL-12, IL-13 and TNF-alpha). Liver (AST, ALT, bilirubin and ALP) and kidney (sodium creatinine and blood urea nitrogen) panels were also conducted. Subjective assessments included fatigue, malaise, headache and reduced mental focus measures.

Treatment with astragalus resulted in statistically significant, dose-dependent increases in total white blood cell count (monocytes, neutrophils and lymphocytes) (p=0.042 for lowest dose and p=0.011 for highest dose) after eight to 12 hours compared to baseline levels.

There was also a significant increase from baseline in cytokine levels (interferon-gamma [p=0.018], TNF-alpha [p=0.046] and soluble IL-2R [p=0.056]) and improvement in fatigue and headache symptoms in subjective assessments.

A separate study also observed a beneficial effect on immune cells with oral use of astragalus root extract.[9] Healthy subjects were given either placebo (n=2), a combination of astragalus, *Glycyrrhiza glabra* (licorice) and *Echinacea purpurea* (echinacea) (n=3) or one of these herbs individually (n=4 each for astragalus and echinacea, n=3 for licorice). The tinctures were administered at a dose of 7.5mL twice daily for seven days, providing 1.23g of astragalus, 0.93g echinacea and 0.87g licorice equivalent to dry.

Astragalus administered individually had the strongest effect on immune cell activation compared with the other individual tinctures. Within 24 hours following ingestion, CD69 expression on CD8 and CD4 T-cells were significantly stimulated compared with minimal cell activation by placebo. After seven days, the level of immune cell activation was less than that at 24 hours but was higher than baseline levels. The combination tincture resulted in CD69 immune cell activation levels higher at 24 hours and seven days after ingestion than those observed in the individual tincture groups. These studies demonstrate that astragalus has a stimulating impact on immune cell number and activity.

### Physical performance

Human and animal data indicates that astragalus and its constituents may have a beneficial influence in physical performance. Astragalus in combination with *Panax ginseng* (Korean ginseng), *Panax quinquefolius* (American ginseng) and creatine (CrBE) was given to 44 adults aged 55-84 years, three times daily during a 12-week strength training program.[11] Compared with placebo or creatine only groups, the CrBE group had more significant improvements in strength, self-reported vigour, and reductions in body fat and cholesterol levels (total, LDL, VLDL, triglycerides, LDL/HDL ratio). There was also a lower incidence of bloating in the CrBE versus creatine-only group.

In a separate study, subjects who had experienced strokes were orally administered either astragalus (equivalent to 2.8g TID) (n=29) or placebo (n=32) for 28 days, with the primary outcome measures being the Brief Fatigue Index (BFI) and quality of life assessments.33 At the end of the treatment period the astragalus group had a greater difference in BFI (p=0.05), global quality of life, cognitive and social functioning scores compared with placebo (p=0.05).

A mice study investigated the effect of astragalus root extract prior to exercise on body composition and physical performance.[12] Animals were orally administered astragalus extract at doses of either 0.615g/kg/day or 3.075g/kg/day or placebo for six weeks (calculated to be equivalent to 3g daily human dosage). Astragalus resulted in improved endurance exercise capacity, hepatic and muscle glycogen content and reduced levels of exercise-induced ammonia and lactate following acute exercise.

A rat study observed that polysaccharides from astragalus given orally at doses of 50, 100 and 200mg/kg for 30 days resulted in a significantly extended length of exhaustive exercise performed and skeletal muscle antioxidant enzyme activity (superoxide dismutase and glutathione peroxidase) compared with placebo.[13]

### Antiviral

Preliminary evidence demonstrates that astragalus and its constituents exhibit antiviral effects. Animal and *in vitro* investigations have observed that astragalus inhibited HSV-1 and Coxsackievirus cell concentration and necrotic size.[14,15]

Constituents of astragalus specifically play a role, with polysaccharides observed to inhibiting EBV expression during the lytic cycle and astragaloside IV reducing replication of human adenovirus *in vitro*.[16,17]

### Diuretic

The traditional application of astragalus as a diuretic has some scientific basis, with evidence indicating a potential beneficial effect.

A double-blind randomised crossover study in 12 healthy males investigated the natriuretic effect of astragalus.[18] Subjects were orally administered a single dose of either astragalus (0.3g/kg aqueous extract) (n=6) or placebo (n=6) and were monitored for the subsequent 24-hour period. Astragalus resulted in an elevated natriuresis rate compared to placebo subsequent to increases in plasma atrial natriuretic peptide and consequent renal response.

## Dosage summary

**Liquid extract (1:2):** 30-60mL weekly[35]
**Dried herb equivalent:** 2-30g dailly[8]
**Immune support:** 2-4.5g daily[35]

## Safety information

- Use during pregnancy and lactation is not advised.[1]
- Caution is advised in individuals with an autoimmune disorder.[36]
- Caution is advised regarding concomitant use with immune suppressing medications.[8]
- According to the TCM treatment paradigm, astragalus is contraindicated in individuals with exterior pathogens, excess qi stagnation, excess internal heat, damp obstruction, or with sores and lesions.[4]

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