Evidence-Based Systematic Review of Dandelion (Taraxacum officinale) by Natural Standard Research Collaboration

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Synonyms/Common Names/Related Substances

- Asteraceae (family), Blowball, cankerwort, clock flower, common dandelion, Cichoroideae (sub-family), Compositae (family), dan-
Clinical Bottom Line/Efficiency

Brief Background

- Dandelion is a member of the Asteraceae/Compositae family closely related to chicory. It is a perennial herb, native throughout the Northern hemisphere, found growing wild in meadows, pastures and waste grounds of temperate zones.
- Dandelion root and leaf are used widely in Europe for gastrointestinal ailments. The European Scientific Cooperative on Phytotherapy (ESCOP) recommends dandelion root for “restoration of hepatic and biliary function, dyspepsia [indigestion], and loss of appetite.” The German Commission E authorizes the use of combination products containing dandelion root and herb for biliary abnormalities, appetite loss, dyspepsia, and for stimulation of diuresis (urine flow). Some modern naturopathic physicians assert that dandelion can detoxify the liver and gallbladder, reduce side effects of medications metabolized (processed) by the liver, and relieve symptoms associated with liver disease.
- Dandelion leaves are a source of vitamin A, containing up to 1400 IU per 100 grams.
- Dandelion is generally regarded as safe with rare side effects including contact dermatitis, diarrhea, and gastrointestinal upset. Tradition-
### Scientific Evidence for Common/Studied Uses:

<table>
<thead>
<tr>
<th>Indication</th>
<th>Evidence Grade</th>
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<tbody>
<tr>
<td>Anti-inflammatory</td>
<td>C</td>
</tr>
<tr>
<td>Antioxidant</td>
<td>C</td>
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<tr>
<td>Cancer</td>
<td>C</td>
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<td>Colitis</td>
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<td>Diabetes</td>
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<tr>
<td>Diuretic</td>
<td>C</td>
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<tr>
<td>Hepatitis B</td>
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<table>
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<tr>
<th>Level of Evidence Grade</th>
<th>Criteria</th>
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<tbody>
<tr>
<td><strong>A</strong> (Strong Scientific Evidence)</td>
<td>Statistically significant evidence of benefit from &gt;2 properly randomized trials (RCTs), OR evidence from one properly conducted RCT AND one properly conducted meta-analysis, OR evidence from multiple RCTs with a clear majority of the properly conducted trials showing statistically significant evidence of benefit AND with supporting evidence in basic science, animal studies, or theory.</td>
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<tr>
<td><strong>B</strong> (Good Scientific Evidence)</td>
<td>Statistically significant evidence of benefit from 1-2 properly randomized trials, OR evidence of benefit from &gt;1 properly conducted meta-analysis OR evidence of benefit from &gt;1 cohort/case-control/non-randomized trials AND with supporting evidence in basic science, animal studies, or theory.</td>
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<tr>
<td><strong>C</strong> (Unclear or conflicting scientific evidence)</td>
<td>Evidence of benefit from &gt;1 small RCT(s) without adequate size, power, statistical significance, or quality of design by objective criteria,* OR conflicting evidence from multiple RCTs without a clear majority of the properly conducted trials showing evidence of benefit or ineffectiveness, OR evidence of benefit from &gt;1 cohort/case-control/non-randomized trials AND without supporting evidence in basic science, animal studies, or theory, OR evidence of efficacy only from basic science, animal studies, or theory.</td>
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<tr>
<td><strong>D</strong> (Fair Negative Scientific Evidence)</td>
<td>Statistically significant negative evidence (i.e., lack of evidence of benefit) from cohort/case-control/non-randomized trials, AND evidence in basic science, animal studies, or theory suggesting a lack of benefit.</td>
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<tr>
<td><strong>F</strong> (Strong Negative Scientific Evidence)</td>
<td>Statistically significant negative evidence (i.e., lack of evidence of benefit) from &gt;1 properly randomized adequately powered trial(s) of high-quality design by objective criteria.*</td>
</tr>
<tr>
<td><strong>Lack of Evidence†</strong></td>
<td>Unable to evaluate efficacy due to lack of adequate available human data.</td>
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</tbody>
</table>

* Objective criteria are derived from validated instruments for evaluating study quality, including the 5-point scale developed by Jadad et al., in which a score below 4 is considered to indicate lesser quality methodologically (Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJ, Gavaghan DJ, McQuay HJ. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Controlled Clinical Trials 1996; 17[1]:1-12).

† Listed separately in monographs in the “Historical or Theoretical Uses Which Lack Sufficient Evidence” section.
ally, the herb is not recommended in patients with liver or gallbladder disease, based on the belief that dandelion stimulates bile secretion (an assertion not demonstrated in animal or human studies).

- Dandelion is used as a salad ingredient, and the roasted root and its extracts are sometimes used as a coffee substitute.

**Historical or Theoretical Uses Which Lack Sufficient Evidence**

- Abscess, acne, age spots, AIDS, alcohol withdrawal, allergies, analgesia, anemia, antibacterial, antifungal, antioxidant, antiviral, aphthous ulcers, appendicitis, appetite stimulant, arthritis, benign prostate hypertrophy, bile flow stimulation, bladder irritation, blood purifier, boils, breast augmentation, breast cancer, breast infection, breast inflammation, breast milk stimulation, bruises, cardiovascular disorders, chronic fatigue syndrome, circulation, clogged arteries, coffee substitute, congestive heart failure, dandruff, diarrhea, dropsy, eye problems, fertility, fever reduction, food uses, frequent urination, gallbladder disease, gallstones, gas, gout, headache, heartburn, high blood pressure, high cholesterol, immune stimulation, increased sweating, jaundice, kidney disease, kidney stones, leukemia, liver disease, liver cleansing, menopause, menstrual period stimulation, muscle aches, nutrition, osteoarthritis, postpartum support, pregnancy, premenstrual syndrome, psoria-
sis, rheumatoid arthritis, skin conditions, skin toner, smoking cessation, stiff joints, stimulant, stomachache, urinary stimulant, urinary tract inflammation, warts, weight loss.

**Expert Opinion and Folkloric Precedent**

- Dandelion root has been used like other bitter herbs, to improve appetite and treat minor digestive disorders. Modern naturopathic physicians consider dandelion to have the ability to detoxify the liver and gallbladder, reduce the side effects of medications processed by the liver, and relieve symptoms of diseases in which impaired liver function plays a role. *In vitro* data and human studies do not support the belief that dandelion stimulates bile secretion.

**Brief Safety Summary**

- **Likely Safe:** When taken orally in amounts naturally found in foods. When taken orally in recommended doses by otherwise healthy adults for medicinal purposes. Dandelion is Generally Recognized as Safe (GRAS) in the United States for food use with a maximum level of 0.014% for the fluid extract and 0.003% for the solid extract.
- **Possibly Unsafe:** When used in amounts greater than recommended doses or when used for a long duration. When used in doses greater than that found in food in patients during pregnancy or lactation. When used in doses greater than that found in food in pediatric patients.
- **Likely Unsafe:** When used in patients with hypersensitivity to dandelion or other members of the Asteraceae/Compositae family (e.g., ragweed, chrysanthemums, marigolds, and daises).

**DOSING/TOXICOLOGY**

**General**

- Recommended doses are based on those most commonly used in available trials, or on historical practice. However, with natural products it is often not clear what the optimal doses are to balance efficacy and safety. Preparation of products may vary from manu-
facturer to manufacturer, and from batch to batch within one man-
ufacturer. Because it is often not clear what are the active components
of a product, standardization may not be possible, and the clinical
effects of different brands may not be comparable.

Standardization

- There are no standard or well-studied doses of dandelion, and
  many different doses are used traditionally. Safety of use beyond
  four months has not been evaluated.
- Dandelion leaves are a source of vitamin A, containing up to 1400
  IU per 100 grams.

Adults (18 Years and Older)

- **Dried Root:** Doses of 2-8 grams taken by infusion or decoction
  have been used.
- **Leaf Fluid Extract:** Doses of 4-8 mL of a 1:1 extract in 25% alco-
  hol have been used.
- **Root Tincture:** Doses of 1 or 2 teaspoons of a 1:5 tincture in 45%
  alcohol have been used.

Children (Younger Than 18 Years)

- There is not enough scientific research to recommend dandelion
  for use in children in amounts greater than found in food.

Toxicology

- The acute toxicity of dandelion (mice intraperitoneal injection) is
  low with an LD$_{50}$ value estimated at 36.8 g/kg for the root and 28.8
  g/kg for the herb. Tita et al. administered up to 10 g/kg orally and 4
  g/kg intraperitoneally in rats and mice and observed a “low toxic-
ity.”
- Twenty rats were fed a diet composed of 32% dandelion rhi-
  zomes to evaluate carcinogenic activity. One rat died 20 days
  after the experiment began and 6 rats died > 200 days after the
  start of the experiment. No tumors were observed in this group.
- Rabbits administered dandelion at doses up to 6 g/kg body weight
  for seven days did not demonstrate visible toxicity.
PRECAUTIONS/CONTRAINDICATIONS

Allergies

- Dandelion should be avoided by individuals with known allergy to dandelion,\(^5,6\) honey,\(^7\) chamomile, chrysanthemums, yarrow, feverfew or any members of the Asteraceae/Compositae plant families (ragweed, sunflower, daisies).\(^8\)
- The most common type of allergy to dandelion is dermatitis following direct skin contact,\(^9-12\) which may include itching, rash, red/swollen or eczematous areas on the skin.\(^13\) Skin reactions are also reported in dogs.\(^14\) The main chemicals in dandelion responsible for allergic reactions are believed to be sesquiterpene lactones. Patch tests have been developed to assess for dandelion allergy.\(^15-17\)
- Rhinoconjunctivitis and asthma have been reported after handling products such as birdfeed containing dandelion and other herbs, with reported positive skin tests for dandelion hypersensitivity.\(^18\)

Side Effects and Warnings

- **General:** Dandelion has been well tolerated in a small number of available human studies. Safety of use beyond four months has not been evaluated.
- **Dermatologic:** The most common reported adverse effect is skin allergy, eczema, or increased sun sensitivity following direct contact.\(^9-13\)
- **Gastrointestinal:** According to traditional accounts, gastrointestinal symptoms may occur, including stomach discomfort, diarrhea and heartburn. There is a 1966 case of a patient who developed intestinal blockage from ingesting a large amount of dandelion greens three weeks after undergoing a stomach operation.\(^19\)
- **Infectious (Contamination):** Parasitic infection due to ingestion of contaminated dandelion has been reported, affecting the liver and bile ducts, and characterized by fever, stomach upset, vomiting, loss of appetite, coughing and liver damage.\(^20\)
- **Endocrine:** Dandelion may lower blood sugar levels based on one animal study,\(^4\) although another study notes no changes.\(^21\) Effects in humans are not known. Caution is advised in patients with diabetes or hypoglycemia, and in those taking drugs, herbs, or supplements that affect blood sugar. Serum glucose levels may need to be
monitored by a healthcare provider, and medication adjustments may be necessary.

- **Hematologic**: In theory, due to coumarins found in dandelion leaf extracts, dandelion may increase the risk of bleeding when taken with drugs that increase the risk of bleeding. Platelet aggregation may also be inhibited.22
- **Renal**: Historically, dandelion is believed to possess diuretic (increased urination) properties and to lower blood potassium levels.
- **Neurologic**: Dandelion may be prepared as a tincture containing high levels of alcohol. Tinctures should therefore be avoided during pregnancy or when driving or operating heavy machinery.

**Precautions/Warnings/Contraindications**

- Avoid use in patients with hypersensitivity/allergy to dandelion or other members of the Asteraceae/Compositae family.
- Use cautiously in patients with bile duct and intestinal obstruction, acute cholecystitis, empyema, and acute gall bladder inflammation (theoretical).
- Use cautiously in patients with digestive disorders, stomach inflammation, or irritable bowel syndrome.
- Use cautiously in patients with diabetes.
- Use cautiously in patients with renal failure.

**Pregnancy and Breastfeeding**

- Dandelion cannot be recommended during pregnancy and breastfeeding in amounts greater than found in foods, due to a lack of scientific information. Many tinctures contain high levels of alcohol and should be avoided during pregnancy.

**INTERACTIONS**

**Interactions with Drugs**

- **General**: Drug interactions with dandelion have rarely been identified, although there is limited study in this area.
- **Ciprofloxacin (Cipro®)**: Based on animal research, dandelion may reduce the effects of the antibiotic ciprofloxacin (Cipro®) due
to reduced absorption of the drug.\textsuperscript{23} In theory, dandelion may reduce the absorption of other drugs taken at the same time.

- **Hypoglycemic Drugs:** Based on an animal study, dandelion may lower blood sugar levels,\textsuperscript{4} although another study notes no changes.\textsuperscript{21} Although effects in humans are not known, caution is advised in patients taking prescription drugs that may also lower blood sugar levels. Those using oral drugs for diabetes or insulin should be monitored closely by a healthcare provider while using dandelion. Dosing adjustments may be necessary.

- **Diuretics:** Historically, dandelion is believed to possess diuretic (increased urination) properties and to lower blood potassium levels. In theory, the effects or side effects of other drugs may be increased, including other diuretics, lithium, digoxin (Lanoxin\textsuperscript{\textregistered}), or corticosteroids such as prednisone.

- **Niacin/Nicotinic Acid:** The effects or side effects of niacin or nicotinic acid may be increased (such as flushing and gastrointestinal upset), due to small amounts of nicotinic acid present in dandelion.

- **Anticoagulants:** In theory, due to coumarins found in dandelion leaf extracts, dandelion may increase the risk of bleeding when used with anticoagulants or antiplatelet drugs. Platelet aggregation may also be inhibited.\textsuperscript{22}

- **Antacids:** It is possible that dandelion may reduce the effectiveness of antacids or drugs commonly used to treat peptic ulcer disease, such as famotidine (Pepcid\textsuperscript{\textregistered}) or esomeprazole (Nexium\textsuperscript{\textregistered}).

- **P450 1A2 and 2E Metabolized Drugs:** There is animal evidence that dandelion may interfere with the way the liver breaks down certain drugs (using the P450 1A2 and 2E enzyme systems). As a result, the levels of these drugs may be raised in the blood, and increase the intended effects or side effects. Patients using medications should check the package insert and speak with a healthcare provider or pharmacist about possible interactions.

- **Flagyl\textsuperscript{\textregistered}**\textsuperscript{2}: Be aware that many tinctures contain high levels of alcohol and may cause nausea or vomiting when taken with metronidazole (Flagyl\textsuperscript{\textregistered}).

- **Disulfiram (Antabuse\textsuperscript{\textregistered})**\textsuperscript{2}: Be aware that many tinctures contain high levels of alcohol and may cause nausea or vomiting when taken with disulfiram (Antabuse\textsuperscript{\textregistered}).
Interactions with Herbs and Dietary Supplements

- **General:** Interactions of dietary supplements with dandelion have rarely been published, although there is limited study in this area.
- **Hypoglycemic Agents:** Based on an animal study, dandelion may lower blood sugar levels, although another study notes no changes. Although effects in humans are not known, caution is advised when using herbs or supplements that may also lower blood sugar. Blood glucose levels may require monitoring, and doses may need adjustment.
- **Diuretic Agents:** Historically, dandelion is believed to possess diuretic (increased urination) properties and may increase the effects of other herbs with potential diuretic effects.
- **Anticoagulant Agents:** In theory, due to coumarins found in dandelion leaf extracts, dandelion may increase the risk of bleeding when taken with herbs and supplements that are believed to increase the risk of bleeding. Platelet aggregation may also be inhibited.
- **P450 1A2 and 2E Metabolized Agents:** There is animal evidence that dandelion may interfere with the way the liver breaks down certain drugs (using the P450 1A2 and 2E enzyme systems). As a result, the levels of other herbs or supplements to be too high in the blood. In theory, dandelion may also alter the effects that other herbs or supplements possibly have on the P450 system, such as bloodroot, cat’s claw, chamomile, chaparral, chasteberry, damiana, *Echinacea angustifolia*, goldenseal, grapefruit juice, licorice, oregano, red clover, St. John’s wort, wild cherry, and yucca.
- **Vitamin A, Lutein, Beta-Carotene:** Dandelion leaves contain vitamin A, lutein, and beta-carotene, and supplemental doses of these agents may have additive effects or toxicity. Vitamin A is fat-soluble and can accumulate in tissues.

Dandelion/Lab Interactions

- **Urine Drug Screens:** Dandelion has been used historically by substance abusers with the intention of masking illicit substances in urine drug screens (anecdotal). However, there is no reliable study in this area.
- **Glucose:** Due to potential hypoglycemic effects, serum glucose concentration may be reduced by dandelion.
• Electrolytes: Due to diuretic effects, plasma sodium or potassium concentrations may decrease with dandelion use. However, no such effects have been found in the available literature.

**MECHANISM OF ACTION**

**Pharmacology**

• Dandelion’s therapeutic effects have historically been attributed to the bitter constituents found in roots and leaves. Research in laboratory animals suggests that dandelion root may possess anti-inflammatory properties. Sesquiterpenes lactones are responsible for diuretic effects and may contribute to dandelion’s mild anti-inflammatory activity. Lactones may increase gastric acid secretion.

• Dandelion is suggested to increase in bile production and flow to the gall bladder (choleretic), and exert a direct effect on the gallbladder causing contraction and release of stored bile (cholagogue). Dandelion leaves also contain appetite-stimulating substances, eudesmanolides, previously known as taraxacum.

• Inulin, a constituent in dandelion, may act to buffer blood glucose levels and has experimental hypoglycemic activity in animals.

• Several laboratory studies report antioxidant properties of dandelion flower extract.

• Potassium is present in the leaves at a concentration of 297mg per 100 grams. Dandelion leaves are a source of vitamin A (1400 units per 100 grams), as well as lutein and beta-carotene. Dandelion is also a source of fiber, potassium, iron, calcium, magnesium, phosphorus, thiamine and riboflavin. Dandelion also contains sodium, vitamin C and vitamin D in lesser concentrations.

**Pharmacodynamics/Kinetics**

• Effects on Phase 1 Metabolism: Activity of hepatic enzyme CYP1A2 in the liver microsomes of rats receiving dandelion in a green tea extract solution was decreased to 15% of a control group (which received water). In the same study, CYP2E activity was decreased to 48% of the control group.

• Effects on Phase 2 Metabolism: Following the ingestion of dandelion in a green tea extract solution, detoxifying enzyme UDP-
glucoronosyl transferase activity increased to 244% of the control group enzyme activity.33

**HISTORY**

- Dandelion was commonly used in Native American medicine. The Iroquois, Ojibwe and Rappahannock prepared infusions and decoctions of the root and herb to treat kidney disease, dyspepsia, and heartburn. In traditional Arabian medicine, dandelion has been used to treat liver and spleen ailments. In traditional Chinese medicine (TCM), dandelion is combined with other herbs to treat hepatitis, to enhance immune response to upper respiratory tract infections, bronchitis or pneumonia, and as a topical compress for mastitis (breast inflammation).
- Dandelion is a perennial herb native throughout the Northern hemisphere, found growing wild in meadows, pastures and waste grounds in temperate zones. Dandelion is very adaptable but prefers moist nitrogen rich soils and altitude less than 6000 feet. Most commercial dandelion is cultivated in Bulgaria, Hungary, Poland, Romania, and the United Kingdom.

**EVIDENCE DISCUSSION**

**Anti-Inflammatory**

- *Evidence:* Research in laboratory animals suggests that dandelion root may possess anti-inflammatory properties.25 There are no well-conducted human studies in this area.

**Antioxidant**

- *Evidence:* Several laboratory studies report antioxidant properties of dandelion flower extract,28-31 although this research is preliminary, and effects in humans are not known.

**Cancer**

- *Evidence:* Limited animal research does not provide a clear assessment of the effects of dandelion on tumor growth.34,35 There are no well-conducted human studies in this area.
Colitis

- **Evidence:** There is a report in several patients that a combination herbal preparation containing dandelion improved chronic pain associated with colitis. Because multiple herbs were used, and this study is not well designed or reported, the effects of dandelion are not clear.

Diabetes

- **Evidence:** There is limited animal research of the effects of dandelion on blood sugar levels in animals. One study reports decreases in glucose levels in non-diabetic rabbits, while another notes no changes in mice. Effects in humans are not known.

Diuretic

- **Evidence:** Dandelion leaves have traditionally been used to increase urine production and excretion. Animal studies report mixed results, and there is no reliable human research in this area.

Hepatitis B

- **Evidence:** One human study reports improved liver function in people with hepatitis B after taking a combination herbal preparation containing dandelion root, called Jiedu Yanggan Gao (also including Artemisia capillaris, Taraxacum mongolicum, Plantago seed, Cephalanoplos segetum, Hedyotis diffusa, Flos chrysanthemi indici, Smilax glabra, Astragalus membranaceus, Salviae miltiorrhizae, Fructus polygonii orientalis, Radix paeoniae alba, Polygonatum sibiricum). Because multiple herbs were used, and this study is not well designed or reported, the effects of dandelion are not clear.

REFERENCES


