Garlic

Vampire Bane, Pizza Topping, and Good for What Ails You?
On the Origins of Garlic

- Egypt and India mention it 5,000 years ago
- China had it 2,000 years ago, possibly 4,000 years ago
- Babylonia had it 4,500 years ago
- But no one knows when garlic was first cultivated . . . .
History of the Herb

- Wherever humans have gone, garlic has followed.
- Introduced to the U.S. with the colonists.
- Only found wild in Asia; everything else called “wild garlic” isn’t actually garlic, but a relative.
Cultivated Garlic: The Lowdown

- **Group:** Monocot
- **Family:** Liliaceae
- **Growth Form:** Forb/herb
- **Duration:** Perennial
- **U.S. Nativity:** Introduced
Lowdown continued

Kingdom: Plantae
Sub-kingdom: Tracheobionta
Super-division: Spermatophyta
Division: Magnoliophyta
Class: Liliopsida
Subclass: Liliidae
Order: Liliales
Family: Liliaceae
Genus: Allium
Species: Sativum L.
Subspecies: var. sativum, var. ophioscorodon
Anatomy of a Condiment

- 90-150 cm tall
- “Hardneck” varieties produce small white, pink, or purple flowers; “softneck” do not
- Long, thin, keeled, flat leaves
- 5-8 cm white, pink, or purple bulbs with 8-20 cloves
So you want to be a garlic farmer?
Down on the farm...

- Garlic likes moist, well-drained sandy loam or loam soils with high OM.
- Soil pH best at 6-7; lime if pH<5.8.
- Garlic needs cold to grow, so plant in the autumn.
- Garlic love nutrients: fertilize in the autumn and spring and spring (yet again).
Still on the farm

- Mild climates are best, but some varieties can tolerate cold. Are you in California or are you in Minnesota?
- Cold climes lead to small bulbs, which means inferior garlic or “hot” garlic.
- “Hardneck” varieties can flower or create “bulbils” aboveground. Plant them for another year!
Smallville continued

- Garlic is grown in rows from planted cloves.
- Only recently have plants been grown to gain seeds; farmers have used bulbs for years!
- Plant cloves pointed side up for optimal growth.
- Mulch to keep weeds down, irrigate to keep the soil moist.
- Harvest by hand.
In the Barn

- Pull out garlic-shoots, bulbs, and all.
- Wash bulb carefully in water.
- Cure for several weeks: hang in bundles (10-15 plants) for several weeks in well-vented room.
- Remove shoots, roots, and outer layer of bulb.
- Store according to use.
The Root Cellar

- **Planting stock:**
  - Store at 60-70% humidity and room temperature.

- **Kitchen stock:**
  - 32-40º F and 60-70% humidity. Room temperature decreases shelf life.

- **Shelf life:** 3-8 months depending on breed.
Now that you’ve got it . . . .

- Garlic is eaten raw or cooked.
- Also made into pills, powders, extracts, or oils.
- Pills are made from powdered garlic: crushed, dried, and chopped up until ground to powder, then stuffed into a capsule for release in the digestive tract.
- Powders are used in cooking.
Garlic, liquified not dry.

- Garlic extracts are aged. Garlic is chopped up finely and then left in alcohol for 2 years.
- Garlic oils are made 2 ways: a) steaming crushed garlic and collecting the oils that escape, or b) chop/crush garlic and soak in vegetable oil for 24 hours, then remove the garlic fragments.
Now that you’ve got it, now what?

- Adulterants are few; pills may be mixed with other compounds to time the release of the garlic. Oils and extracts use oils and alcohol, respectively.
- Taken internally (ingestion).
- Distinct aroma is negated by timing of release and breakdown of key chemicals (or by use of a breath mint and a hot shower).
Constituents

- A large number of sulfur compounds are the most important constituents and contribute to the smell and taste of garlic.
- Diallyl sulfide is believed to be an important odor component.
  - organosulfur compound found in plants of the genus Allium. Principal component of the essential oil of garlic
- Alliin- organic compound (amino acid) that is a natural constituent of fresh garlic that not involved in the building of proteins
**Constituents cont...**

- **Allicin** (C₆H₁₀OS₂) - chemical compound not present in garlic in its natural state but a degradation product from the naturally occurring cysteine sulfoxide, alliin.

- When garlic is chopped or otherwise damaged, the enzyme allinase acts on the chemical alliin converting it into allicin. Not a very stable compound and degrades slowly upon standing and rapidly destroyed by cooking.
Analytical Methods

- Extraction of garlic cloves with ethanol at <0°C produces Alliín.
- Extraction with ethanol and water @ 25°C produces Allicin only.
- Steam distillation (100°C) converts the alliín to diallyl sulfides entirely.
Chromatogram

- Qualitative and quantitative assay for sulfur constituents (e.g. Alliin, Allicin) by means of high performance liquid chromatography or gas chromatography-mass spectroscopy methods.
- All of the compounds identified are breakdown products of the primary flavor compounds.
- GC and GC-MS used to characterize allium volatiles.
- However, these chromatographic techniques are valued for study of compounds of moderate thermal stability.
- Thiosulfinates from allium species known to decompose on heating or attempted GC analysis.
How garlic works:

- When garlic is crushed, the compound alliin is converted into the compound allicin (gives of characteristic garlic odor).
- During digestion allicin is broken down into the compound ajoene.
- In the gastrointestinal tract, ajoene enters the blood stream.
  - Allicin and ajoene are compounds that show the most "healing potential"
How garlic is “applied”

- Ingested (natural/pill form):
  - enters the gastro-intestinal tract
  - absorbed into blood stream in the stomach or intestines

- Topical (natural, poultice)
  - poultice applied to wound/infected area
  - not recommended because it's been known to cause second degree burns
Possible Treatment for:

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<th>Outdoor</th>
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<tr>
<td>Atherosclerosis</td>
<td>Hypertension</td>
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<td>Intestinal Parasites</td>
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<td>Roundworms</td>
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<td>Stroke</td>
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How much garlic to take:

- For children, medical dosage not established yet.
- For adults, recommended medical dosage (ingested):
  - **Raw garlic (whole):** 2-4 grams/day fresh (1 clove = approx. 1 gram)
  - **Capsules/tablets:** 600-900 mg/day
  - **Infusion:** 4 g/150 ml water/day
  - **Fluid extract:** 4 ml/day
  - **Oil:** 0.03-0.12 ml three times/day
Efficacy

- Anti-hypertensive activity (no consistent effect)
- Anti-microbial activity (insufficient data)
- Anti-neoplastic activity: epidemiological suggestion of positive effect)
- Anti-thrombotic activity (modest antiplatelet effect)
- Hypoglycemic activity (no effect)
- Lipid-lowering activity (modest, positive short-term effect)
**Contraindications**

- To patients with a known allergy to the drug
- Consumption of large amounts may increase the risk of post-operative bleeding according to a study done in 1995 in *Journal of plastic and reconstructive surgery*
- No objections to use of garlic during pregnancy and lactation
- Excretion of components of garlic into breast milk and effect on newborn not yet established
- No precautions reported concerning drug and laboratory test interactions, pediatric use or teratogenic or non-teratogenic effects on pregnancy
- Overall level of safety to garlic reflected by its world wide use as a seasoning in food
Adverse Effects

- Has been reported to evoke occasional allergic reactions such as contact dermatitis (chemical burns on skin) and branchial asthmatic attacks after inhalation of the powdered drug.
- Ingestion of fresh garlic bulbs, extracts, or oil on empty stomach may cause heartburn, nausea, vomiting and diarrhea.
- When administered orally to laboratory animals garlic caused stomach ulcers, anemia, decrease in serum protein, inhibition of spermatogenesis and decrease in intestinal flora.
- Garlic odor from breath and skin may be perceptible
- Processing methods greatly affect chemical structure of garlic preparations and adverse effects can be eliminated by proper extraction and preparation method.
Drug interactions

- Avoid concomitant use of Garlic with:
  - Anticoagulants: avoid concomitant use, garlic may add to the effect of anticoagulants, increasing risk for bleeding complication
  - Antiplatelet agents and thrombolytic agents: theoretical risk of increased bleeding risk
  - Serious concerns over surgery or contraindications with anticlotting medications such as Warfarin
  - Patients on warfarin therapy should be warned that garlic supplements may increase bleeding times
  - Blood clotting times have been reported to double in patients taking Warfarin and garlic supplements (Pharmaceutical journal, 1991).
References


References


- PDR for Nonprescription Drugs, Dietary Supplements and Herbs. Thompson PDR 2006; NewJerse


References


Created By:

- Bemnet Abebe
  - bgessess@umd.edu
- Jessica Boualavong
  - boualavong@gmail.com
- Allen Dawson
  - ladydarley@gmail.com

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