1C: Season for a Reason: Spicing Up a Healthy Diet

Deborah Cohen, DCN, RD

Saturday, July 8, 2017
1:00 p.m. – 2:30 p.m.
Season for a Reason: Spicing up a Healthy Diet

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Disclosures:
None

Objectives
Review research regarding spices and the treatment of Type 2 diabetes
Review culinary uses of spices (curcumin, ginger, cinnamon, fenugreek)
Present dosages and administration of select spices
When people hear the word **SPICE** or **SPICY**...this is what they think of....

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**Spices are defined as:**
“Vegetable products or mixtures thereof, free from extraneous matter, used for flavoring, seasoning, and imparting aroma to foods”

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**Herbs** come from the leafy and green part of the plant.

**Spices** are parts of the plant other than the leafy bit such as the root, stem, bulb, bark or seeds.

**Difference between herbs and spices used for flavoring is somewhat arbitrary**
Spices are:
- Buds (clove)
- Bark (cinnamon)
- Roots, rhizomes (ginger)
- Berries (pepper, cumin)
- Aromatic seeds (cumin)
- Stigma of a flower (saffron)

Ancient Egypt
- Spices used for health, as preservatives
- Wooden cloves of garlic found in tomb of King Tutankhamen

Greece and Rome
- Hippocrates, Galen, Dioscorides used multiple spices as remedies

China
- The use of plants for health benefits is shrouded in legend—emperors used herbs and spices for medicinal properties

India
- Ayurvedic use for >5000 years

Spices have been recognized for their health benefits for many, many years….HOWEVER, it has only been in the last few decades-ish, that their attributes have been experimentally verified.
## Culinary Herb and Spice Intake Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Intake Phase</th>
<th>Intake Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellegri et al. (2012)</td>
<td>Determined daily intake of spices using a 3 day weighed food record (3D-WFR) and food frequency questionnaire (FFQ). For the FFQ, incomplete range data were obtained.</td>
<td>Median intake of total daily intake: 2.4 g per person. Range: 0-2.7 g. Interquartile range: 1.6 g (men) and 1.3 g (women). Country of study: Italy.</td>
</tr>
<tr>
<td>Calafat et al. (2004)</td>
<td>Determined herb and spice intake using a FFQ and 24-weeks daily (28 days recording of herbs and spices consumption) in 186 subjects (men n=108 and women n=78) of varied ages.</td>
<td>Median intake of total daily intake: 0.2 g per person. Range: 0.1-0.3 g. Interquartile range: 0.15 g (men) and 0.04 g (women). Country of study: France.</td>
</tr>
</tbody>
</table>

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### Some Spices Are Becoming More Popular

<table>
<thead>
<tr>
<th>Spice</th>
<th>Percentage Change in Availability per Decade Compared to 1960</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEVER SEED</td>
<td>1.3</td>
</tr>
<tr>
<td>CELERY SEED</td>
<td>1.0</td>
</tr>
<tr>
<td>PEAPOD</td>
<td>1.2</td>
</tr>
<tr>
<td>MINT</td>
<td>1.1</td>
</tr>
<tr>
<td>ROSEMARY</td>
<td>0.9</td>
</tr>
<tr>
<td>FRENCH HERB</td>
<td>0.8</td>
</tr>
<tr>
<td>HERBS</td>
<td>0.7</td>
</tr>
<tr>
<td>GARLIC</td>
<td>0.6</td>
</tr>
<tr>
<td>BALANCE</td>
<td>0.5</td>
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</tbody>
</table>

Adapted from Peter & Shylova (2012) and Seidt & Singh (2012)
Culinary Uses of Spices
- Flavoring
- Preservative
- Coloring agents

Health Benefits of Spices
- Medicinal
- Antifungal
- Antiviral
- Antibacterial
- Antioxidants

Medicinal Uses of Spices
- Curcumin
Infusions
Decoctions
Macerations
Tinctures
Fluid extracts
Teas, juices, syrups
Poultices
Oils
Ointments, powders

Ginger decoction

Antioxidant Properties of Spices

- Free radicals lead to ROS
- ROS induce lipid peroxidation in cell membranes and generate lipid peroxides that cause damage
- Phenolic compounds and flavonoids are antioxidants in spices that scavenge free radicals (ROS)
Polyphenols exhibit anti-glycation properties.
Polyphenols are metabolized by gut flora and/or the liver and eliminated from the body rapidly. Some polyphenols are thought to exert a prebiotic effect by stimulating the growth and activity of some bacteria (e.g., Bifidobacterium).

Intestinal absorption and thus, bioavailability of dietary polyphenols is low (~5-10%).

Bioavailability of Polyphenols

Cooking and Antioxidant Bioavailability

- Microwaving, simmering and stewing • increases
- Dry heating (roasting, broiling, sautéing, grilling and frying) • decreases
Besides phenolic compounds, there are numerous unidentified compounds in spices that may also have beneficial effects.

Spices & Major Bioactive Compounds

- **Cinnamon** (cinnamaldehyde)
- **Ginger** (A & B-type procyanidin, gingerol)
- **Turmeric** (curcumin)
- **Cumin** (cuminaldehyde, cuminol)
- **Coriander** (phenolics, flavonoids)
- **Anise** (trans-anethole)
- **Fenugreek** (galactomannan, soluble fiber, saponins)
- **Black pepper** (piperine)

**Diabetes and Integrative Medicine**

WHO estimates 347 million worldwide with diabetes (2015)

~2-3.6 million people in the US rely on CAM therapy for treatment of diabetes; $34 billion spent on CAM in the US in 2013

Compliance of traditional therapies limited by:
- Complex treatment regimens
- Hypoglycemia
- Medication side effects
- Patient beliefs
In 2014, imports of C. cassia to the US totaled ~28,000 tons, predominately from Indonesia.

>250 species of the cinnamon genus have been identified.

4 used to obtain the spice.

Greek: “sweet food”

Cinnamon bark oil has been used for centuries in Western and traditional Eastern medicine, including Indian Ayurvedic and Unani systems.
Species of Cinnamon:

- *Cinnamomum cassia* (cassia or Chinese cinnamon, the most common commercial type); stronger effects on glycemic control
- *C. burmannii* (Korintje, Pudang cassia, or Indonesian cinnamon)
- *C. loureiroi* (Saigon cinnamon, Vietnamese cassia, or Vietnamese cinnamon)
- *C. verum* (C. zeylanicum; Sri Lanka cinnamon or Ceylon cinnamon; also referred to as true cinnamon, higher levels of coumarin)
- *C. citriodorum* (Malabar cinnamon)
- *C. tamala* (Indian cinnamon)

Forms of Cinnamon:
- harvested sticks of bark (or quills)
- pulverized bark powder
- extracts
- oils derived from the powder

Supplement forms of Cinnamon:
- *C. cassia* (type most commonly sold in US grocery stores)
- *C. burmannii*
- *C. loureiroi*

Chemical Constituents of Cinnamon:

<table>
<thead>
<tr>
<th>Part of the plant</th>
<th>Compound</th>
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</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>Cinnamon aldehydes 14.1% to 51.6%</td>
</tr>
<tr>
<td></td>
<td>Eugenol 70.3% to 95.5%</td>
</tr>
<tr>
<td>Bark</td>
<td>Cinnamon aldehydes 67.3% to 88.8%</td>
</tr>
<tr>
<td></td>
<td>Eugenol 5.0% to 80.5%</td>
</tr>
<tr>
<td>Root bark</td>
<td>Camphor 46.6%</td>
</tr>
<tr>
<td>Fruit</td>
<td>Cinnamaldehyde 62.3% to 74.4%</td>
</tr>
<tr>
<td></td>
<td>and eugenol 76.0% to 83.0%</td>
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<tr>
<td>Fruit Cinnamaldeh</td>
<td>Cinnamaldehyde 76.0%</td>
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<td>and genins 78.0%</td>
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<td>Fruit eugenol</td>
<td>Eugenol 86.9%</td>
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<tr>
<td>Fruit Cinnamaldeh</td>
<td>Cinnamaldehyde 76.0%</td>
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<td>and eugenol 78.0%</td>
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</table>
Health Benefits of Cinnamon

- Glycemic control
- Antioxidant
- Anticoagulant properties
- Anti-inflammatory
- Anti-cancer
- Antimicrobial
- Cholesterol and lipid lowering

Cinnamon & Glycemic Control

- Increased autophosphorylation of the insulin receptor
- Inhibition of pancreatic and intestinal amylase and glucosidase
- Increased glycogen synthesis in the liver
- Increases GLUT 4 synthesis and activation

Medagama AB. Nutrition J. 2015;14:108
Animal studies (rats, mice):

Cinnamaldehyde
- increases plasma insulin levels
- increases liver glycogen content
- decreases TG and LDL-cholesterol levels

Cinnamon oil
- contains >98% cinnamaldehyde
- reduces FBG
- reduces total cholesterol
- increases HDL cholesterol


Objective: To determine whether the use of cinnamon by adults with T2DM met the American Diabetes Association clinical treatment guidelines for glycemic control, as measured by changes in FPG or HbA1c.

- 11 RCT met inclusion criteria
- N=694 adults with T2DM
- Studies ranged from 4 to 16 weeks in duration; 7 studies were double-blind
- Cinnamon doses: range 120 to 6,000 mg/day.
- The species of cinnamon used varied: C. cassia or C. aromaticum, 1 used C. zeylanicum; 3 did not disclose the species

- All 11 of the studies reported some reductions in FPG during the cinnamon intervention
- HbA1c: modest reduction with cinnamon
- Only 4 studies achieved the ADA treatment goals
  - FPG <130 mg/dL and/or A1c <7.0
- Only 4 studies obtained dietary intake records; different forms, doses of cinnamon used
- Not possible to R/O other changes that might also have affected FBG and HbA1c (compliance with meds, diet, physical activity)
Objective: To evaluate the effects of cinnamon in patients with diabetes mellitus.


Selection criteria: All randomized controlled trials comparing the effects of orally administered monopreparations of cinnamon (Cinnamomum spp.) to placebo, active medication or no treatment in persons with either type 1 or type 2 diabetes mellitus.

Data collection and analysis: Two review authors independently selected trials, assessed risk of bias and trial quality, and extracted data.

Results: 10 prospective, parallel-group design, randomized controlled trials (N=577) participants with type 1 and type 2 diabetes mellitus.

Mean dose: 2 g daily, for a period ranging from 4 to 16 weeks.

The effect of cinnamon on FBG: inconclusive.

No statistically significant difference in HbA1c, serum insulin or postprandial glucose was found between cinnamon and control groups.

Conclusions: Small sample size

Adverse reactions to oral cinnamon were infrequent and generally mild in nature.

There is insufficient evidence to support the use of cinnamon for type 1 or type 2 diabetes mellitus.
Most studies ranged from 4-18 weeks which is not long enough to study effects on A1c.

Caution:
- On anti-coagulants (esp warfarin)
- Liver disease

Clinical Trials (clinicaltrials.gov)

Dosage & Administration

Cut or ground bark:
- 2-4 g per day

Infusion or Decoction:
- 0.7-1.3 g in 150 ml water, 3x/day

Fluid Extract 1:1 (g/ml):
- 0.7-1.3 ml, 3x/day

Tincture 1:5 (g/ml):
- 3.3-6.7 ml, 3x/day

Essential Oil:
- 0.05-0.2 ml

Cassia cinnamon:
- 120 mg to 6 grams daily

Source: American Botanical Council
Cinnamon has a delicate flavor and is used in both sweet and savory dishes.

Popular in Asian and Middle Eastern cuisine to provide flavor to lamb, rice dishes and curries.

Part of a mixed spice powder ‘garam masala’ used widely in Indian cooking.

## Culinary Uses of Cinnamon

- Sprinkle on apple crumble, pie
- Add to mulled wine
- Cinnamon yogurt or ice cream
- Sprinkle on cereals or hot chocolate
- Boil a cinnamon stick with warm milk
- Ground cinnamon is a great addition to fruit desserts which use apples, prunes, pears and apricots

## Incorporating Cinnamon into the Diet

- Cinnamon tea
  - As an ingredient in homemade cakes and biscuits
  - Sprinkle on French or cinnamon toast
  - Added to rice pudding
  - Make ice cream or cinnamon hand
  - Ground cinnamon offers a unique taste when added to black beans in a nachos or burritos recipe

## Purchasing & Storing Cinnamon

Cinnamon sticks will have a strong flavor and will stay fresh up to 1 year.

Ground cinnamon usually has a short shelf life (up to 6 months).

Store in tightly sealed glass containers which are kept in a dry, cool and dark place.

For longer shelf life, cinnamon can be stored in the refrigerator.
Ceylon cinnamon:
sweeter, lighter in color, powder is finer

Cassia cinnamon:
darker in color

Turmeric

Turmeric is derived from the plant Curcuma longa

Cultivated primarily in India;
Major ingredient of mustard preparations
Turmeric has been used for at least 2500 years.

Agent of beauty: turmeric paste applied to face as a mask to improve skin appearance and to help fading of blemishes.

Antibacterial agent (effective against H. pylori).

Indian ceremonies: weddings and religious ceremonies.

Ayurvedic and Chinese herbal medicine: used to support liver function and to treat jaundice.

Relief from dental problems—gingivitis (turmeric mouthwash) and periodontitis (2% turmeric gel).

Turmeric contains >300 different components.

Curcumin: most bioactive component makes up 2-5% of the spice.

Bioactive compounds include:
- Curcumin (a curcuminoid)
- Phenolic compounds
- Terpenoids
Animal studies

- Decreased susceptibility of LDL to lipid peroxidation
- Inhibition of platelet aggregation
- Reduced cholesterol uptake in the gut
- Anticancer activity
- Anti-inflammatory activity
- Anti-depressant activity
- Wound healing

Human studies

- Inflammatory conditions
- Cancer
- Diabetes and its complications (diabetic microangiopathy, retinopathy)
- IBS
- Acne
- Fibrosis


5 studies; 10 treatment arms (n=133 in the curcumin and n=90 in the control group)

Meta-analysis of findings did not indicate a significant effect of curcumin on any of the lipid parameters.

Conclusions: Curcumin supplementation had no effect on serum total cholesterol, LDL-C, triglycerides and HDL-C levels when considering heterogeneous populations.
Limitations
Color
Low bioavailability
poor absorption
rapid metabolism
rapid systemic elimination
Piperine may enhance bioavailability

Advantages
Well tolerated, safe

Feasibility of Turmeric

Hyperlipidemia
Turmeric extract 1.4 gms daily in two divided doses
Pakhale L et al. Indian J Comm Health 2012;24(2):113-117

Diabetes
Curcumin 750 mg twice daily

Dosage and administration

Culinary uses of Turmeric
Using Ground Turmeric

Smoothies: use 1 tsp for a subtle turmeric flavor. Add up to 2 tsp for a more intense flavor. Include coconut oil in your smoothie to boost the turmeric absorption.

Add 1-2 tsp to any soup recipe. It will add a deep golden hue.

A natural in curries or stews. Sauté the vegetables in oil and add in 1 tsp of ground turmeric.

Add a color pop to rice dishes by adding ½ tsp turmeric to the water when cooking the rice.

Boost the healthiness of mac and cheese by stirring in ½ tsp to cheese sauce.

Tea, add in ¼ tsp ground turmeric to the mug before pouring in the hot water.

Golden pancakes: Add ½ tsp to dry pancake mix.

Hummus: Combine ½ tsp with 1 tbsp of toasted sesame seeds and sprinkle over hummus.

Cook lentils or other legumes with onions, olive oil and 1 tsp ground turmeric.

Using Fresh Turmeric

To use the fresh root, you first need to peel it.

Just like ginger root, peel the skin using the edge of a spoon.

Grate with a microplane grater or cut off whole pieces.

Wrap the unused portion tightly in plastic wrap and store in the refrigerator for a week to 10 days.

Add a 1-inch piece of turmeric root to smoothies or to freshly pressed juices.

Use 1 tsp freshly grated root in marinades for chicken, fish, and beef. Stir freshly grated turmeric into salad dressings.

Intensify the flavor and color of pumpkin pie, pumpkin muffins, or a pumpkin loaf. Stir in 1 tsp of freshly shredded turmeric to the batter and bake as usual.

Add 1-2 tsp of freshly grated turmeric to stir-fry. Add it in while sautéing the vegetables.

Sprinkle into scrambled egg dishes, frittatas, or quiches; the color of the turmeric will enhance the color of the eggs.

Make a savory yogurt bowl: Top plain Greek yogurt with 1 tbsp of grated fresh turmeric, 1 tsp freshly ground black pepper, a pinch of sea salt, and a tsp of olive oil.
Ginger

Zingiber officinale roscoe
Perennial plant
The spice comes from the tuberous rhizome of the plant
Bioactive compounds

- Gingerols—specifically 6-gingerol —most biologically active component
- Shogaols—dehydrated form of gingerol (degradation product)
  - Potential anticancer (lung, breast) (in vitro and in vivo)
- Zingerone
- Paradol

Ginger: 1000 mg/d x 10 weeks


Randomized, double-blind, placebo-controlled trial

\(N = 36\) patients on PD were randomly assigned to either the ginger (n=18) or the placebo (n=18) group.
- Men: ginger group: n=13, placebo n=10
- Mean age: ginger group: 56, placebo group 58
- No significant differences in weight or BMI (mean 27) between groups

Outcome measures: serum concentrations of glucose, carboxymethyl lysine, pentosidine, malondialdehyde (MDA), hs-CRP, soluble intercellular adhesion molecule type 1 (sICAM-1), soluble vascular cell adhesion molecule type 1 (sVCAM-1), sE-selectin
Results
• Serum FBG decreased significantly (P < 0.05)
• A1c not measured
• There were no significant differences between the two groups in mean changes of serum carboxymethyl lysine, pentosidine, MDA, hs-CRP, sICAM-1, sVCAM-1, and sE-selectin.

4 RCT’s (range N=32 - 88 per study)
4 were considered high quality and lasted 8-12 weeks (1 lasted 30 days)
Outcomes: FBG, insulin, HOMA, IR, A1c
Results:
Ginger supplementation significantly lowered FBG concentrations and HbA1c levels, but did not significantly lower fasting blood insulin or HOMA-IR.

N=88 randomized into ginger powder (n=40) and placebo (n=41) groups [7 dropped out of the study for various reasons]; mean age ~50 years
Dose: 1 gm ginger powder 3 times per day x 8 weeks
Outcomes: insulin resistance (fasting insulin, HOMA-IR), A1c, FBS
Results: FBS decreased in the ginger group by 10.5% (p = 0.003); HOMA-IR, fasting insulin decreased significantly--this occurred in ginger and placebo groups.


Double blind, placebo controlled trial

Age range: 20-60 years not on insulin

Dose/duration: 3 gm powdered ginger or placebo daily for 3 months

Results: Significant decreases in serum glucose, A1c, and insulin
Data regarding bioavailability are limited

At 48–60 hours after oral consumption of ginger, 6-gingerol and 6-shogaol: excreted mainly via bile, urine

Relatively safe; adverse effects include heartburn side effects most common at doses >5 gm/day

Drug interactions: Nifedipine
Ginger tea
Gingerbread, scones
Add grated ginger to fresh fruit, juices, cakes, cookies, soups, steamed rice
Goes well in recipes including:
Fish stew
Chicken, pork, beef stir fry recipes
Carrot soup
Green beans

Fenugreek
Hypoglycemic effect, most likely due to its high fiber & pectin content which slows GI emptying.

Seeds contain free amino acids which stimulates release of insulin.

Bioactive components:
- Trigonelline
- 4-hydroxyisoleucine
- sotolon


Placebo-controlled double-blind study to assess the effects of fenugreek on insulin resistance.

2 month study
N=25 patients with type 2 diabetes
n=12 randomized received 1 g/dl of fenugreek extract
n=13 randomized to placebo (dietary control, exercise)

Results:
Significant decrease (28.4 mg/dL) in fasting BG levels in patients who received fenugreek compared to placebo (decrease of 24.5 mg/dL) (p < 0.05)
Only patients who received fenugreek showed a significant decrease in HbA1C from 8.25 (+1.2) to 7.54 (+0.9; p<0.5)

10 trials included in analysis (4 parallel, 6 crossover); N=278
Age range 22-54, 4 years; 76% males
Fenugreek seeds, debitterized powdered fenugreek seeds, hydroalcoholic seeds, ingredient in unleavened bread (n=1)
Duration >7 days
Large variation of dose: 1-100 gm per day

Results
- Fenugreek significantly reduced FBG, 2-hour BG, A1c compared to controls
- Doses >5 gms/day were more effective at lowering BG
- Debitterized fenugreek powdered seeds showed the greatest reduction of BG levels

Mild side effects:
- primarily GI (dyspepsia, mild abdominal distention), strong urine smell

Studies that used doses <5 gm/day reported no effects, whereas studies using higher doses showed greater effects on glycemic control.

Objective

• To evaluate the safety and efficacy of a polyherbal formulation (PHF) that consisted of Allium sativum, Aloe vera, Nigella sativa, Plantago psyllium, Silybum marianum and Trigonella foenum-graecum for controlling dyslipidemia and hyperglycemia in patients with advanced-stage of type-2 diabetes.

N=30 recruited, 25 completed the study (some were on statins, oral hypoglycemic agents)

Duration: 40 days

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Materials used in the polyherbal formulation.</th>
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</thead>
<tbody>
<tr>
<td>No.</td>
<td>Material name</td>
</tr>
<tr>
<td>1</td>
<td>Allium sativum L.</td>
</tr>
<tr>
<td>2</td>
<td>Allium sativum L.</td>
</tr>
<tr>
<td>3</td>
<td>Nigella sativa L.</td>
</tr>
<tr>
<td>4</td>
<td>Nigella sativa L.</td>
</tr>
<tr>
<td>5</td>
<td>Plantago psyllium L.</td>
</tr>
<tr>
<td>6</td>
<td>Silybum marianum L.</td>
</tr>
<tr>
<td>7</td>
<td>Trigonella foenum-graecum L.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Table 2</th>
<th>The levels of serum glucose and lipids before and after treatment with polyherbal formulations (PHF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>2-4 weeks before study</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>196-120</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>139-105</td>
</tr>
<tr>
<td>Total cholesterol and TG: p&lt;0.05</td>
<td></td>
</tr>
</tbody>
</table>

32
• PHF was safe at the given doses

• There may have been a synergistic effect from all the plant constituents

Caution

Known peanut or chickpea allergies
On anticoagulants
Avoid fenugreek supplements during pregnancy
• may affect uterine contractions
• birth defects observed in animal studies
Potential adverse effects
• diarrhea, abdominal distension, flatulence
• maple smell to urine

Culinary uses of Fenugreek

Central ingredient in Indian Cuisine (cumkha) and to flavor mango chutney
Roasted fenugreek sometimes used as a substitute for coffee
Ingredient in the Jewish version of halvah, a confectionary consumed in the Middle East and Asia

Kadhai paneer made with fenugreek seeds and leaves
Using Fenugreek in Cooking

Seeds have a bitter/musty taste/odor

Seeds require longer cooking time than leaves

Leaves are available fresh, frozen or dried; dried leaves retain flavor best

Stir a handful of the fresh chopped leaves into a stew of potatoes and garbanzo beans

Simmer a pot of homemade tomato sauce with a drizzle of clarified butter and crushed dried leaves.

Flavor braised green peas with dried or fresh fenugreek leaves, salt and a hint of cream.

A pinch can also be sprinkled over yogurt, cooked greens, or sauce.

Fresh leaves can be added to salads and cooked dishes.

Store whole and ground fenugreek in an airtight container; in a cool, dry, and dark location for up to 6 months.

Fresh fenugreek leaves have a short shelf life and should be used immediately.

Synergy?

Single food/spice vs polyphenol/multi spice/multi food combinations

The outcome of combining dietary polyphenols and their foods is influenced by:

- The constituents themselves
- The number of constituents (food or polyphenol) that make up the combination
- The amount/concentration of a constituent
- Any processing that the constituent may undergo (cooking method)
Limitations of Published Research Regarding Spices

- Clinical vs statistical significance
- Small sample sizes
- Supplements vs actual foods
  - Processing of plant to make a supplement may affect pharmacological properties
- Lack of uniformity across multiple dimensions
  - Varying patient characteristics
  - Inconsistent formulations of supplement and dose
  - Differing study durations

Patient/Client Challenges

Cost of supplement (often not covered by insurance)
Cost of the spice
Inconsistent amount of bioactive ingredient
No regulation (supplement)

Patient/Client Challenges

Storage issues
Consistent use
How to use in cooking?
No specific guidelines or recommendations for intake (food or supplements)
But... where's the spice?

"The pedicure was on his head, the psychiatric nurse was on his mind, the giant's vonage was on his nose, and the fertility doctor was on his eggs from..."