

TURMERIC

Pennington Biomedical Research Center

Pennington Nutrition Series

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About Turmeric



Turmeric root

Turmeric, known as *Curcuma longa* L., belongs to the Zingiberaceae or ginger family. It is a flowering plant, a perennial herb that measures about 40 inches in height and has white flowers.

It has creeping tuberous rhizomes that are harvested for food. It is distributed throughout tropical and subtropical regions of the world, such as Asia, Africa and the Americas. The rhizomes are harvested and processed before they are ground to yield the yellow powder known as turmeric. The yellow colored compound of turmeric was isolated in 1842 and was named curcumin. There are several curcuminoids that have slightly different chemical structures. The curcuminoids are phenols and hence are strong antioxidants. However, turmeric and curcuminoids are non-toxic.

Because of its chemical structure, curcumin is a strong antioxidant and free radical scavenger and can therefore prevent diseases that involve damage caused by free radicals.

There are many uses for turmeric in the traditional Asian and Indian medicine.

Turmeric is used in cases of biliary disorders, intestinal disorders, anorexia, cough, diabetic wounds, hepatic disorder, pain, rheumatism and sinusitis, cancer, psoriasis and Alzheimer's disease.

Culinary uses of Turmeric



As a powder, turmeric has been used as a spice in vegetable and meat preparations in many Asian countries for centuries. Turmeric adds a distinctive

yellow color and flavor to foods. It is rarely used alone, but is combined with several other spices to make vegetarian and non-vegetarian curries, sauces and spice blends. In prepared foods, turmeric is used in mustard, mayonnaise, chutneys, pickles

and sauces. Turmeric is used in meat, poultry and fish in addition to vegetables dishes. It is used for its color and taste in foods, and as a fresh root, it can be added to beverages such as tea for its medicinal effects. Turmeric is non-toxic and can be consumed daily.

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Special points of interest:

- Turmeric is a strong antioxidant.
- Turmeric affects thousands of genes.
- Turmeric is used as a spice in food, as a coloring agent and in medicine.

Turmeric, oxidative stress and inflammation



Turmeric is a widely used spice.

Inflammation is caused by the release of chemicals in the cells called inflammatory cytokines. Oxidative stress is the build up of free radicals in cells. Curcuminoids, due to their structure that contains benzene rings and hydroxyl groups, are strong antioxidants and can reduce the concentration of free radical compounds such as hydroxyl radicals, superoxide radicals, singlet oxygen and nitric oxide in biological systems. Eliminating these reactive oxygen species can help prevent LDL oxidation and reduce the risk

for cardiovascular disease, cancer, diabetes, Alzheimer's and alcoholic liver disease. Curcuminoids can also improve the antioxidant status in the body by increasing the circulation of antioxidant vitamins C and E, and enhancing other enzyme systems.

Curcuminoids have been shown to suppress the production of a number of inflammatory cytokines including tumor necrosis factor, interleukin-1, interleukin-8, interleukin-12 and chemokines that are released in conditions such as

rheumatoid arthritis, psoriasis, cancer and asthma, and by external stressors. Curcuminoids can inhibit NF-kappa B, a factor that is involved in stimulation of the immune system when an individual is subjected to stresses such as radiation or infection. Curcuminoids stop the immune system from responding by blocking a reaction that would lead to a host of negative responses. They also decrease the levels of inflammatory prostaglandins E(1), E(2), F(2a) and D(2) that cause pain, fever and blood clotting.

Turmeric and Alzheimer's Disease



Alzheimer's is a difficult diagnosis for the person and their family.

The incidence of neurodegenerative diseases is expected to grow as the population ages. Many of these, including Alzheimer's disease have been linked to inflammation and oxidative stress. Not only is Alzheimer's linked to oxidative stress but currently at least four genes have been linked to the prevalence of Alzheimer's. Several natural compounds in plants look promising as treatments for diseases such as Alzheimer's disease. Many plant compounds have been found to be strong antioxidants that reduce oxidative stress in cells including resveratrol, epigallocatechin gallate, genistein and

curcumin. Each has been shown to be effective in reducing inflammation and modulating harmful compounds in cells.

Curcumin, the polyphenol in turmeric affects many proteins in the cell and influences a host of cellular pathways. It has been shown to be effective in reducing Alzheimer's disease pathologies. As Alzheimer's progresses, there is a formation of amyloid beta-protein (ABP) plaques in the brain. There are two different types of ABP's in the brain. Studies show that curcumin significantly reduces the more harmful type that

forms neurotoxic plaques in the brain seen in Alzheimer's disease patients. ABP destroys normal brain cells but treatment with curcumin stops the process. Treatment with curcumin makes the amyloid ABP less stable, at least in cell cultures. In addition, curcumin treatment reduces ABP production by inhibiting an enzyme that is essential for its production, as well as causing other cellular changes that interfere with ABP maturation. In addition, curcumin influences ABP at the genetic level by decreasing its production.

Turmeric and cancer

Both epidemiological evidence and clinical trials have shown that diet high in turmeric is protective against certain types of cancers.

Research findings indicate that the compounds in turmeric are very effective in combatting cancer in many ways. They inhibit the formation of chemicals in the cell that allow cancerous changes and increase chemicals that inhibit them. Curcumin, a polyphenol in turmeric, increases components in cells that hasten irregular cell death, stop abnormal cell growth,

reduce new blood vessel formation, and increase the proteins in a cell that are responsible for its own demise. Because of these properties, it can be used to treat cancer. In particular, curcumin seems to be involved in regulating the expression of genes implicated in cell growth, cell transformation, chemotherapy resistance, and in the formation and development of new blood vessels. Curcumin seems to be effective in many types of malignancies including brain, breast, cervical, colon, kid-

ney, pancreatic and prostate cancers, leukemia, melanoma, and osteosarcoma.

A study in cell culture revealed that turmeric was in fact a highly potent agent against osteosarcoma cells by eliminating all cells after treatment with an extract.

In addition to curcumin itself being able to kill cancer cells, it also enhances the action of conventional drugs used to treat cancer by making the cells more sensitive to the drugs.

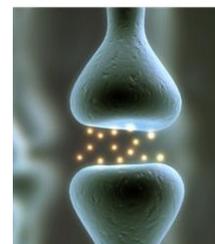
Turmeric is a member of the ginger family.

Turmeric and arthritis

Arthritis is inflammation of one or more joints. A joint is the area where two bones meet. There are over 100 different types of arthritis. The inflammation in the joints causes breakdown of the cartilage, stiffness and swelling. There are many types of conventional medications as well as dietary supplements used to treat arthritis. One of those is turmeric. Turmeric is

an anti-inflammatory agent and can therefore relieve symptoms in conditions that are due to inflammation. Both the curcuminoids and essential oils of turmeric have been found to be useful in reducing arthritic symptoms. Curcuminoids reduce the synthesis of inflammatory molecules in the body that cause arthritis. In animal studies, joint inflammation was reduced up

to 100% in treated animals. Curcuminoids and essential oils are more effective if the treatment starts before the joint is inflamed. In addition, curcuminoids also prevent bone destruction by suppressing genes that are involved in bone turnover. Curcuminoids also help to maintain bone mineral content, leading to reduced incidence of osteoporosis.



Turmeric can reduce inflammation.

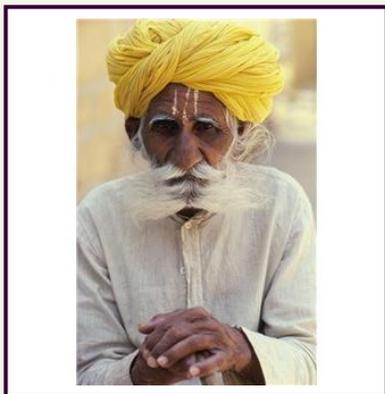
Turmeric and blood glucose and lipids

The metabolic syndrome is a clustering of several factors such as obesity, diabetes, hypertension and its hallmarks are central obesity, high blood lipids, glucose and insulin levels. Metabolic syndrome can lead to diabetes without treatment. There are several drugs that are used to treat blood lipids and insulin levels. Turmeric has the potential to be used as a natural compound to stabilize blood lipids and glucose levels. Turmeric

fed to diabetic mice in controlled feeding studies led to decreased blood glucose levels in mice receiving various levels of turmeric for four weeks compared to the control group. In another study, despite food intake being the same, the animals fed turmeric at various concentrations vs control diets, gained less weight and had smaller abdominal fat stores. They were also able to maintain their blood glucose levels normal during the

feeding phase. The control animals had an increase in blood glucose throughout the study. When the animals were assessed for changes in gene expression, over 1100 genes were found to be affected. There were several genes in glucose metabolism, fatty acid synthesis, and fat and cholesterol metabolism that were influenced by turmeric feeding. Turmeric feeding had a positive effect on glucose and lipid levels in mice.

Turmeric and traditional uses



Turmeric is used as coloring for the turban.

Turmeric has been grown in India and the other far eastern nations for over 4000 years and it has been used as a culinary staple in many cultures. It also has a place in many religious ceremonies. In Hinduism it is important particularly at weddings where a necklace of turmeric is used in place of a wedding ring. It is used as a dye for holy robes and as a paste to decorate the skin for religious events.

Turmeric has been used in Ayur Vedic medicine and traditional Asian and African systems of medicine to treat a wide variety of ailments including arthritis, ulcers, jaundice, wounds, fever, trauma as well as skin diseases such as psoriasis. It is applied

to the skin for the prevention and cure of skin conditions and ingested for clearing hepatic conditions, ulcers and digestive disorders. It has also been used in the treatment of intestinal parasites and as a remedy for poisoning, snakebites, and various other complaints. Current traditional Asian medicine uses it against biliary disorders, anorexia, coryza, cough, diabetic wounds, hepatic disorder, rheumatism and sinusitis.

Turmeric is also used for skincare. It is used to brighten the skin, clean and exfoliate and reduce fine lines and wrinkles. It is also used for acne and to reduce oiliness.

Pennington Biomedical Research Center

VISION

Our *vision* is to lead the world in eliminating chronic diseases.

MISSION

Our *mission* is to discover the triggers of chronic diseases through innovative research that improves human health across the lifespan. We are helping people live Well Beyond the Expected.

The Pennington Center has several research areas, including:

- Clinical Obesity Research
- Experimental Obesity
- Functional Foods
- Health and Performance Enhancement
- Nutrition and Chronic Diseases
- Nutrition and the Brain
- Dementia, Alzheimer's and healthy aging
- Diet, exercise, weight loss and weight loss maintenance

The research fostered in these areas can have a profound impact on healthy living and on the prevention of common chronic diseases, such as heart disease, cancer, diabetes, hypertension and osteoporosis.

The Division of Education provides education and information to the scientific community and the public about research findings, training programs and research areas, and coordinates educational events for the public on various health issues.

We invite people of all ages and backgrounds to participate in the exciting research studies being conducted at the Pennington Center in Baton Rouge, Louisiana. If you would like to take part, visit the clinical trials web page at www.pbrc.edu or call (225) 763-3000.

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