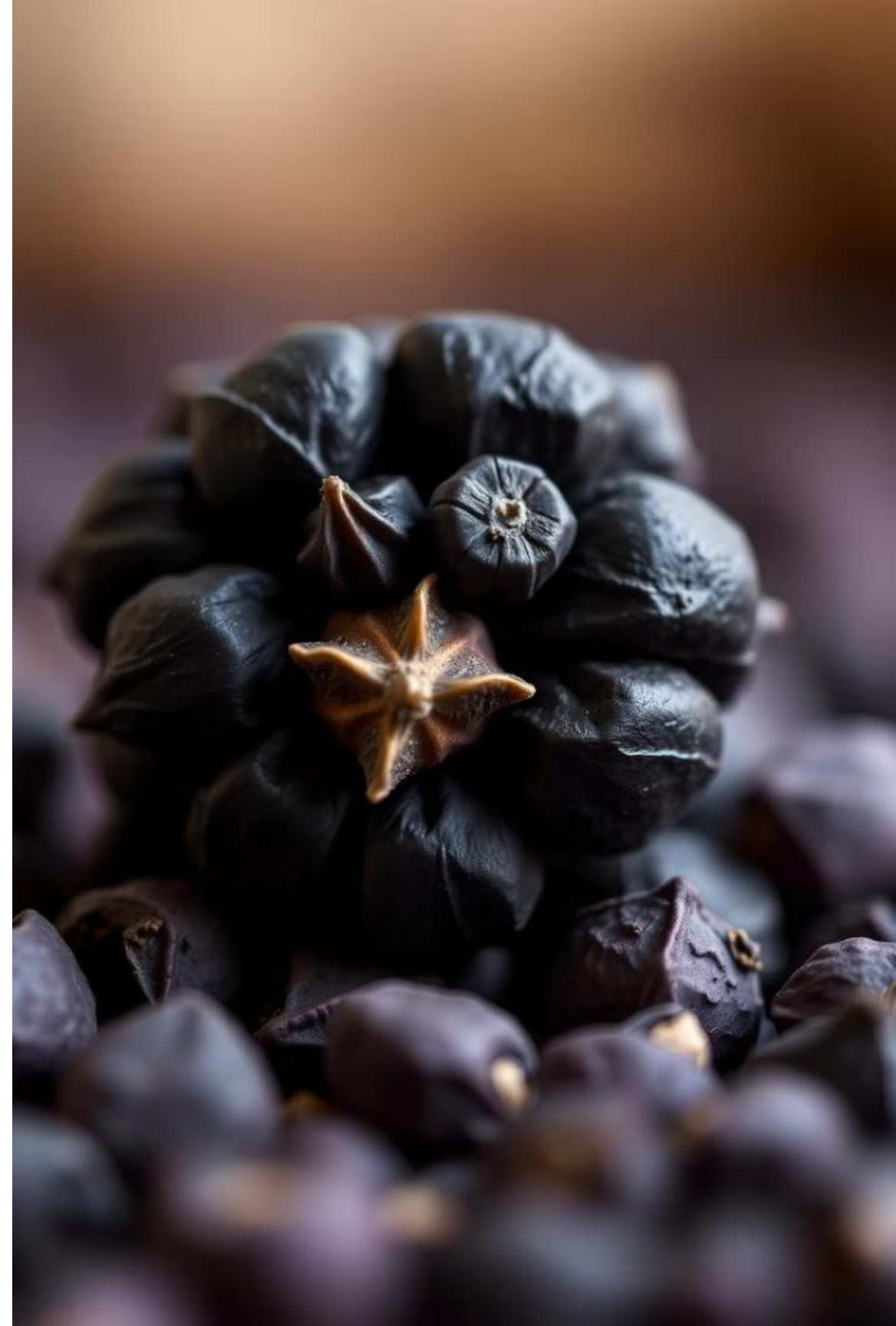


Black Pepper

From its humble origins to its modern-day applications, black pepper holds a remarkable history and profound impact on human health.

Hawraa kaream



The History and Origins of Black Pepper

Ancient Roots

Black pepper originated in India, where it has been cultivated for over 2,000 years. It was highly valued in ancient civilizations for its flavor and medicinal properties.

Global Trade

During the Middle Ages, black pepper became a prized commodity, fueling the spice trade between Asia, Europe, and Africa. This demand propelled global exploration and influenced the development of empires.

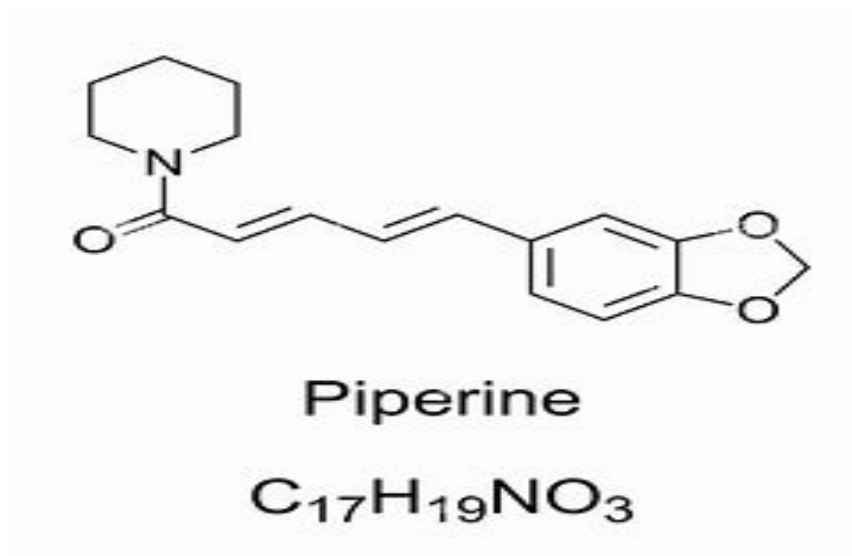
Active Compounds in Black Pepper: Piperine and its class

Piperine

The most notable active compound is piperine, responsible for black pepper's pungent flavor and numerous health benefits.

Other Compounds

In addition to piperine, black pepper contains other bioactive compounds, including flavonoids, terpenes, and alkaloids.





Piper Nigrum

Isomers of Piperine:

1. **Piperine (trans-trans isomer)** – The naturally occurring and most stable form.
2. **Isopiperine (cis-trans isomer)** – A geometric isomer where one of the double bonds is in the *cis* configuration.
3. **Chavicine (cis-cis isomer)** – Another geometric isomer; it is less stable and tends to revert to piperine over time.
4. **Isochavicine (trans-cis isomer)** – Another minor isomer.

Among these, **piperine** is the most bioavailable and biologically active form, while the other isomers are usually formed as a result of isomerization under heat or acidic conditions.

An illustration of the human digestive system, including the esophagus, stomach, and intestines, rendered in shades of pink and purple. A whole black pepper pepper with a green stem and a yellow band is positioned in the stomach area. Numerous small black peppercorns are scattered throughout the digestive tract, particularly in the stomach and small intestine.

The Bioavailability and Absorption of Black Pepper Compounds

1

Enhanced Absorption

Piperine has been shown to improve the bioavailability of certain nutrients, including curcumin, vitamin C, and beta-carotene, by increasing their absorption in the digestive tract.

2

Increased Bioavailability

The presence of piperine in black pepper can enhance the body's ability to utilize various nutrients and bioactive compounds.

How piperine increase absorption

- **inhibits CYP450 enzymes** → Slows drug metabolism, increasing bioavailability.
- **Blocks P-glycoprotein (P-gp)** → Prevents drug efflux, enhancing absorption.
- **Increases intestinal permeability** → Allows better drug uptake.
- **Boosts gastrointestinal blood flow** → Improves drug transport.
- **Reduces glucuronidation** → Slows drug elimination, prolonging effects.

Examples of Drugs/Nutrients Enhanced by Piperine

- **Curcumin (Turmeric)** → 2000% increase in bioavailability
- **Resveratrol** → Increased plasma levels
- **Rifampicin, Phenytoin, Theophylline** → Delayed metabolism
- **Vitamins (A, C, B6, Selenium, CoQ10)** → Improved absorption



An anatomical diagram of the human digestive system is shown on the left side of the slide. The diagram is a light blue silhouette of a human torso with internal organs highlighted in a darker blue. The organs shown include the esophagus, stomach, liver, gallbladder, pancreas, small intestine, and large intestine. In the bottom left corner, there is a small cluster of dark blue/black peppercorns on a green stem.

Medicinal Applications of Black Pepper: Digestive Health

Digestive Support

Black pepper has been used for centuries to aid digestion. Its pungent flavor stimulates the production of saliva and gastric juices, helping break down food and improve nutrient absorption.

Anti-inflammatory Effects

Piperine's anti-inflammatory properties can soothe digestive upset and reduce the risk of gastrointestinal disorders.

Black Pepper and Cardiovascular Benefits

1

Blood Pressure

Studies have shown that black pepper may help regulate blood pressure by promoting the relaxation of blood vessels.

2

Cholesterol

Piperine may also play a role in reducing cholesterol levels, contributing to a healthier cardiovascular system.

Anti-inflammatory Properties of Black Pepper

1

Antioxidant Activity

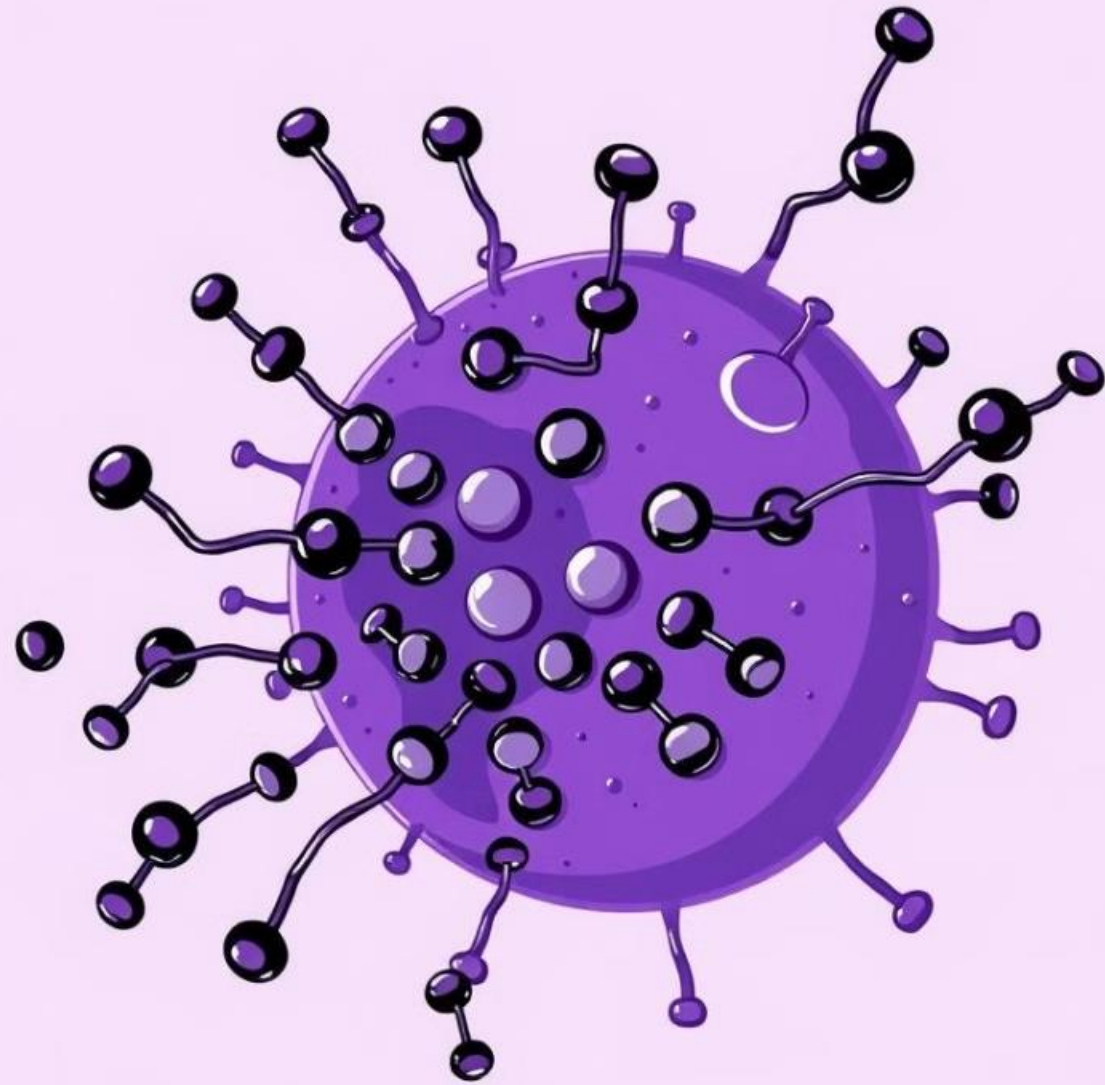
Black pepper's antioxidant properties help protect cells from damage caused by free radicals, reducing inflammation throughout the body.

2

Pain Relief

Piperine's anti-inflammatory effects can provide pain relief from conditions such as arthritis and muscle soreness.





Black Pepper's Role in Cancer Prevention and Treatment

1

Cell Growth Inhibition

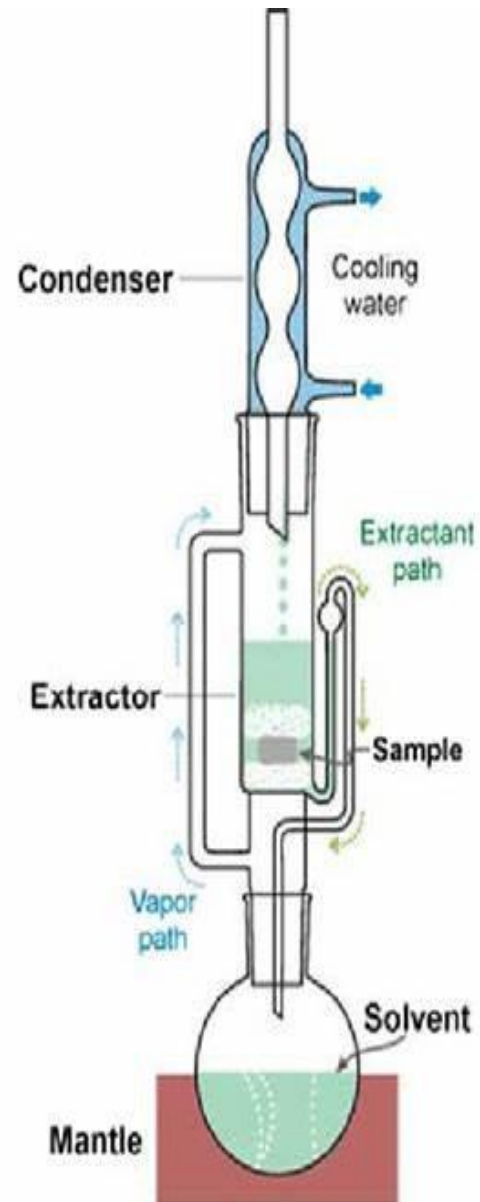
Research suggests that piperine may inhibit the growth of cancer cells by interfering with their cell cycle and promoting apoptosis (programmed cell death).

2

Chemotherapy Enhancement

Studies show that piperine can increase the effectiveness of certain chemotherapy drugs, potentially improving treatment outcomes.

Solvent Extraction



1

10 g fine powder of black pepper with 200 ml 95% ethanol in Soxhlet

2

**filtration and concentrate by water bath
then adding 10 % KOH and left over night**

3

Yellow needles

Reasons for Adding KOH in Piperine Extraction

1

Hydrolysis of Unwanted Compounds

Raw extracts from black pepper contain various organic acids, esters, and other unwanted compounds. KOH helps hydrolyze these impurities, making it easier to separate piperine from other components.

2

Conversion of Piperine Isomers

Some piperine isomers (e.g., chavicine) may be present in the extract. KOH can facilitate the conversion of these isomers back into the more stable and bioactive trans-trans piperine form.

Phytochemical tests

1

Mayer test

2

Wagner test



