

Piper nigrum

Piperine, Black Pepper

Indications

Orally, *Piper nigrum* is used to increase absorption of various water- and fat-soluble nutrients, including vitamin B6, β -carotene, selenomethionine, coenzyme Q10 (CoQ10), curcumin, resveratrol, and others.

Mechanism of Action

Piperine, a highly lipophilic alkaloid extracted from *Piper nigrum*, significantly enhances the bioavailability of various nutrients through increased absorption.¹ Piperine does this by inhibiting enzymes that metabolize drugs and nutritional substances, stimulating amino acid transporters in the intestinal lining, inhibiting P-glycoprotein, and decreasing intestinal production of glucuronic acid.¹ Studies show increased absorption rates of 30%–60% for curcumin (from turmeric),² resveratrol,³ CoQ10,⁴ β -carotene,⁵ and vitamin B6. In one study, the increased absorption of 2 g of curcumin with 20 mg of piperine was 2000%.² It is thought that piperine works by increasing blood flow to the gastrointestinal tract, thereby promoting active nutrient transport. The precise mechanism responsible for its absorption-enhancing activity is not fully understood. Piperine passes through the intestinal barrier very quickly. It is theorized that it may function as an apolar molecule and form apolar complexes with nutrients and other compounds, thereby modulating membrane dynamics and thus helping to increase absorption across intestinal barriers.⁶

Evidenced-Based Research

A small, double-blind, placebo-controlled, randomized trial was conducted on 23 adults to study the effect of piperine on absorption of resveratrol. Several studies suggest that resveratrol can enhance cerebral blood flow. The participants were either given trans-resveratrol (250 mg), trans-resveratrol with 20 mg of piperine, or a placebo. The doses were given on separate days at least a week apart. After a rest and absorption period of 40 minutes, study participants were asked to perform cognitive tasks. Throughout the period, Near-infrared spectrometry was used to assess cerebral blood flow in the frontal cortex. Liquid chromatography–mass spectrometry was used to confirm the presence of resveratrol and its conjugates in the plasma. The results showed that the combination of piperine and resveratrol significantly increased cerebral blood flow while performing cognitive tasks in comparison with placebo and resveratrol alone.³

The therapeutic effects of curcumin from *Curcuma longa* are reduced because of its poor bioavailability. The addition of piperine increases the bioavailability of curcumin in healthy human volunteers and rats.² First, curcumin only was given to rats, in a dose of 2 g/kg. Over a period of 4 hours, moderate serum concentrations of curcumin were measured. Next, 20 mg/kg of piperine was given along with the curcumin. This combination was able to increase the serum concentration of curcumin by 154% for a

short period of 1–2 hours postadministration. The effect on human volunteers was significantly more pronounced. In humans, absorption of curcumin was very low when taken alone. Serum levels were either undetectable or very low after a dose of 2 g. When 20 mg of piperine was combined with the curcumin, blood concentrations of curcumin were increased by 2000% from 0.25 to 1 hour postadministration. There were no observed adverse effects.²

Safety in Pregnancy and Breastfeeding

Pregnancy: If used orally and in amounts typically found in foods piperine is likely very safe. If taken orally in very large amounts, there is a possible safety concern. A mouse study found that piperine might have anti-implantation activity when taken in very high daily doses of 75 mg/kg of body weight (the 150-pound human equivalent is a dose of 5 g).⁹

Breastfeeding: There are no data on this subject. It is probably best to use piperine in small, food-like doses or to avoid it.

General Safety

Piper nigrum is generally regarded as safe when taken in typical food-like doses of around 360 mg/day, yielding 18–32 mg of piperine. Studies on the long-term use of high doses of piperine are lacking.

Piperine affects CYP450 isoenzymes CYP1A1, -1B1, -1B2, -2E1, and -3A4 at doses as low as 20 mg. Examples of drugs whose bioavailability would be increased include barbiturates, dapson, ethambutol, isoniazid, phenytoin, propranolol, rifampicin, sulfadiazine, theophylline, and fexofenadine.^{7,8} Nutrients whose absorption could be increased include β -carotene, CoQ10, selenomethionine, pyridoxine, glucose, and amino acids.⁷

Dosage

In North America, an average diet contains about 360 mg of black pepper per day or about 18–32 mg of piperine. Black pepper consists of 5%–9% piperine.

Doses of 5–10 mg of piperine are given concomitantly with nutritional supplements (such as turmeric and resveratrol) to enhance absorption.

Traditional Uses

Ayurvedic medicine uses *Piper nigrum* extensively to enhance bioavailability. Approximately two thirds of all traditional ayurvedic formulas contain this herb.

References

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