

# Medical effects of pistacia species consumption

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## **Gastrointestinal effects**

The number of bioactive components extracted from Pistacia species are so abundant including terpenoids, sterols and phenolic agents. These plants have many biological activities including anti-microbial, antioxidant, cytotoxic and phytotoxicity effects due to its chemical constituents. The antimicrobial activities of Pistacia species have been recognized in various studies. The extract oil of Pistacia Vera had some antifungal effects stronger than nystatin. A new study has discovered the components of Pistacia Terebinthus by GC, GC-MS responsible for anti-fungal activity. The most dermatophytes showed high sensitivity against  $\alpha$ -pinene, camphene,  $\beta$ -pinene, terpinolene and  $\beta$ -phellandrene exist in the leaves of Pistacia terebinthus. A Turkish study described the potent antibacterial efficacy of oil extract of Pistacia Vera against Escherichia coli, Staphylococcus aureus. Obviously this has an essential role in prevention of diarrhea and other gastrointestinal disorders in natural medicine. Moreover, the extract of Pistacia Integerrima has relaxant and spasmolytic activities as well as anti-asthmatic effects. The mechanism of action looks to be by blocking the muscarinic receptors of gut. The antispasmodic action of Pistacia Integerrima has benefit the asthmatic patients as well and many studies will be designed in the future to prove it.

## **Anticancer**

As mentioned the variety of compounds in Pistacia species has given a unique characteristic to resolve many different disorders including cancer cells. In fact they act as chemoprotective anticancer naturotherapy to resolve the side effects of chemotherapy such as nausea, vomiting and hair

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loss. A study shows that *Pistacia Integerrima* crude extract inhibited breast cancer MCF-7 cell line by 97% dose-dependently. Instead of using anti-emetic medications with some neurological side effects such as metoclopramide, the antiemetic effect of the aqueous extract of leaves and nuts of *Pistacia Vera* in young chickens was studied. Emesis was induced by copper sulfate (60 mg/kg, orally) and ipecac (600 mg/kg, orally). The aqueous extract was injected intraperitoneally. The maximum nonfatal doses of the aqueous extracts were 100 mg/kg and 150 mg/kg, respectively. The antiemetic activity was unraveled to be due to central and/or peripheral receptors. In the recent years there have been many studies on the anticancer potential of extracts derived from mastic resin. The inhibition of cancer cell growth of prostate cancer, hepatic cancer, glioblastoma cells, lung cancer and even leukemia has been reported by mastic resin of *Pistacia Lentiscus*.

### **Analgesic and antipyretic effects**

Pain and fever are manifestations of inflammation. Extract of *P. integerrima* galls was evaluated in mice for their analgesic effects. At a dose of 200 mg/kg, it showed significant analgesic response. At 50–200 mg/kg, it alleviated acute and chronic inflammation. The crude methanolic extract of *P. integerrima* bark was evaluated for antipyretic activity in mice model. At a dose of 100 mg/kg, the extract exhibited significant antipyretic effect. *P. integerima* bark extract-derived pistagremic acid possesses strong peripheral and central antinociceptive activity. In rat model, the terpene ameliorated carrageenan-induced edema. By docking studies, the antipyretic effect was explained to be by manipulation of COX-2 enzyme.

**Hypoglycemic effect**

Diabetes, a metabolic disease with pleiotropic health consequences is fast emerging as an epidemic. Prevention and treatment strategies largely focus on postprandial glycemia reduction. A randomized study on type 2 diabetic patients revealed that consumption of 25 g pistachio nuts twice/day for 12 weeks can decrease glycated hemoglobin (HbA1c) and fasting blood glucose level. The intervention outcome suggests the glycemic control potential of the nuts.

**Hypotensive, anti-atherosclerotic and cardioprotective**

Hypertension can lead to a gamut of cardiomyopathies such as asphyxia, atherosclerosis, atrial fibrillation, myocardial ischemic injury, stroke, cardiac arrest etc. Lowering of dyslipidemia and restoring blood pressure to normalcy can improve heart health. Nuts consumption has been validated beneficial in this regard. The methanolic extract of *P. vera* nuts decreased the aortic surface lesions rabbit model of atherosclerosis. In a randomized study, pistachios nuts consumption for 4 weeks decreased the serum oxidized-LDL concentration through cholesterol-lowering and may provide an added benefit as a result of the antioxidants the pistachios contain. A moderate-fat diet containing *P. vera* nuts moderately improves some cardiovascular risk factors in diabetic adults. A systematic review of randomized controlled trials, nuts intake, including that of *P. vera* has healthy effects on blood pressure. *P. lentiscus* var. *chia* resin was evaluated in human subjects for possible cardiac benefits. Ingestion of the resin powder at 5 g/daily dose for 18 months led to improvement in serum parameters as reflected in lower total cholesterol, LDL and apolipoprotein B levels.

**Digestive**

*P. lentiscus* resin was evaluated for its digestive properties. Functional dyspepsia patients were administered with the gum. The ingestion of 350 mg thrice/day for 3 weeks ameliorated the symptoms of the bowel discomfort such as stomach pain and heartburn, better than placebo.

**Antimicrobial**

Gastric disorder, ulcer etc. are often due to bacterial activity. *Helicobacter pylori* as a driver of gut inflammatory Crohn's disease is well-validated. *P. lentiscus* at an oral dose of 500 mg/kg ameliorated gastric and duodenal ulcers in rats. *P. atlantica* fruit oil extract improved ulcerative colitis in rat models. Microbiome, the microbes distributed on various niches of human body has been proven critical for immune status and neural homeostasis. Optimization of the microbiome, by dietary intervention has been consistently suggested. Increasing the consumption of nuts, including that of pistachio appeared beneficial in improving gut microbiota composition. It promoted the abundance of butyrate-producing bacteria over lactic acid bacteria. The gum-derived essential oil of *P. lentiscus* var. Chia was investigated against a range of foodborne pathogenic and food spoilage microbes. The oil dominated by  $\alpha$ -pinene and  $\beta$ -myrcene were most effective against *Clostridium perfringens*, *Saccharomyces cerevisiae* and *Zygosaccharomyces bailii*. Gram positive microbes were more susceptible compared to Gram negative microbes. Another study reports that efficacy of the *P. lentiscus* essential oil in pathogenic inhibition is due to the synergistic effect of the components in it, highlighting the role of trace components like

verbenone, alpha-terpineol, and linalool. The findings raised the possibility of their addition in food processing.