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**FILE: ■Olive (*Olea europaea*) Oil
■Chemistry
■Biological Activity**

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RE: Olive Oil's Active Components and Benefits, A Review

Waterman E, Lockwood B. Active components and clinical applications of olive oil. *Altern Med Rev.* 2007;12(4):331-342.

Olive (*Olea europaea*) oil is a major component of the Mediterranean diet, which is associated with a reduced risk for chronic diseases including heart disease and cancer. Research suggests that the type of fat consumed "is more important than the total amount consumed." The relatively high levels of monounsaturated fatty acids (MUFA) and antioxidants found in olive oil, the main energy source in the Mediterranean diet, may be at least partially responsible for its protective effect against degenerative diseases.

Olive oil contains about 70% oleic acid, a MUFA. Studies on the health benefits of oleic acid have produced mixed results, but it may protect against the development of cancer. One in vitro study indicates that oleic acid acts synergistically with the cancer drug trastuzumab against cell cultures that over-express the Her-2/neu oncogene.

Olive oil also contains phenolic compounds that provide health benefits. These compounds are found in higher levels in extra virgin olive oil compared to refined olive oil. The phenolic compounds hydroxytyrosol and oleuropein are antioxidants that scavenge free radicals and prevent oxidation of low-density lipoprotein (LDL) cholesterol, which prevents the development of atherosclerotic plaques. Olive oil itself has a higher antioxidant capacity than most seed oils, and extra virgin olive oil has a greater antioxidant capacity than refined olive oil. The phenolic compounds in olive oil "are capable of scavenging free radicals produced in the fecal matrix, which is thought to explain the epidemiological data suggesting a colonic chemopreventative effect of olive oil."

Squalene is a triterpene that is found in relatively high levels in olive oil and the Mediterranean diet. The lower incidence of skin cancer in populations that consume the Mediterranean diet is believed to be due to the effects of squalene, which has been shown to

inhibit skin carcinogenesis in animal studies. Squalene has also been shown to inhibit HMG-Coa reductase, an important enzyme in cholesterol synthesis. Acute administration of squalene increases the rate of cholesterol synthesis. Studies on chronic administration of squalene have produced conflicting results, including increased, decreased, and unchanged cholesterol levels. These conflicting results may be dose-related. Heating and storing olive oil affects its chemistry. Conventionally heating olive oil results in a time-dependent loss of the beneficial phenolic compounds. Studies on microwave cooking have produced mixed results; however, the length of time seems to have major effect on degradation of its constituents. Olive oil has relatively high levels of MUFAs and low levels of polyunsaturated fatty acids (PUFAs) compared with other cooking oils. Therefore, it is less susceptible to lipid peroxidation, which is associated with cancer and cardiovascular disease. In addition, the antioxidants found in olive oil prevent lipid peroxidation during long-term storage, and they prevent the formation of carcinogenic heterocyclic amines during frying.

The antioxidants found in olive oil may contribute to the reduced risk of coronary heart disease and hypertension associated with the Mediterranean diet. Research indicates that olive oil has antihypertensive effects. One study shows that individuals with high blood pressure can reduce reliance on antihypertensive drugs if they consume a diet rich in olive oil. The mechanism of action for this antihypertensive effect is not clear. Several mechanisms have been suggested including action as a calcium channel antagonist like the drug verapamil, improvement of endothelial function, decrease of vascular tone, and changes in the fatty acid and phospholipids composition of the aorta.

The antioxidants found in olive oil and the fruits and vegetables in the Mediterranean diet are associated with a decreased cancer risk. Hydroxytyrosol prevents cell damage, blocks cell cycle progression, and induces apoptosis. Pre-clinical studies show that oleuropein has antiangiogenic effects, disrupts actin filaments thus disrupting cancer cells, and inhibits cell growth, motility, and invasiveness. One in vivo study has shown that oleuropein has anti-tumor effects. Olive oil may also protect against cancer by replacing saturated animal fats and polyunsaturated plant fats, which are associated with various types of cancer. In vitro studies indicate that virgin olive oil phenolic compounds have anti-cancer effects against colorectal carcinogenesis at all three stages. Phenolic glycosides and oleic acid are stored in the body's fatty tissues, which may prevent breast cancer by reducing lipid peroxidation in the phospholipid bilayer of breast tissue. Case control studies indicate an inverse relationship between olive oil and breast cancer, as well as high mammographic breast density, a risk factor for breast cancer. In vitro studies show that several constituents of olive oil have antimicrobial activity against bacteria associated with intestinal and respiratory infections. In addition, phenolic compounds in virgin olive oil are active against *Helicobacter pylori*, which is associated with gastric ulcers and gastric cancer. The research suggests that virgin olive oil may prevent *H. pylori* infections, but in vivo research is needed to confirm this action and to elucidate the mechanism of action.

The antioxidant effect of olive oil has been found to reduce the inflammation associated with rheumatoid arthritis. Olive oil also appears to act synergistically with Omega-3-fatty

acids to reduce the symptoms of rheumatoid arthritis. In addition, consumption of olive oil protects against the development of rheumatoid arthritis.

The authors conclude "The evidence indicates...that olive oil and its components contribute significantly to the health benefits of the Mediterranean diet, with more of an effect on prevention than treatment."

—*Marissa N. Oppel, MS*

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