

TOMATOES & LYCOPENE

Abstract: Lycopene is the pigment principally responsible for the characteristic deep-red color of ripe tomato fruits and tomato products. It has attracted attention due to its biological and physiochemical properties, especially related to its effects as a natural antioxidant. Although it has no provitamin A activity, lycopene does exhibit a physical quenching rate constant with singlet oxygen almost twice as high as that of β -carotene. This makes its presence in the diet of considerable interest. Increasing clinical evidence supports the role of lycopene as a micronutrient with important health benefits, because it appears to provide protection against a broad range of epithelial cancers.

Tomatoes and related tomato products are the major source of lycopene compounds, and are also considered an important source of carotenoids in the human diet. Undesirable degradation of lycopene not only affects the sensory quality of the final products, but also the health benefit of tomato-based foods for the human body. Lycopene in fresh tomato fruits occurs essentially in the all-trans configuration. The main causes of tomato lycopene degradation during processing are isomerization and oxidation. Isomerization converts all- trans isomers to cis -isomers due to additional energy input and results in an unstable, energy-rich station. Determination of the degree of lycopene isomerization during processing would provide a measure of the potential health benefits of tomato-based foods. Thermal processing (bleaching, retorting, and freezing processes) generally cause some loss of lycopene in tomato-based foods.

Heat induces isomerization of the all- trans to cis forms. The cis -isomers increase with temperature and processing time. In general, dehydrated and powdered tomatoes have poor lycopene stability unless carefully processed and promptly placed in a hermetically sealed and inert atmosphere for storage. A significant increase in the cis -isomers with a simultaneous decrease in the all- trans isomers can be observed in the dehydrated tomato samples using the different dehydration methods. Frozen foods and heat-sterilized foods exhibit excellent lycopene stability throughout their normal temperature storage shelf life.

Lycopene bioavailability (absorption) can be influenced by many factors. The bioavailability of cis -isomers in food is higher than that of all- trans isomers. Lycopene bioavailability in processed tomato products is higher than in unprocessed fresh tomatoes. The composition and structure of the food also have an impact on the bioavailability of lycopene and may affect the release of lycopene from the tomato tissue matrix. Food processing may improve

lycopene bioavailability by breaking down cell walls, which weakens the bonding forces between lycopene and tissue matrix, thus making lycopene more accessible and enhancing the cis - isomerization. More information on lycopene bioavailability, however, is needed. The pharmacokinetic properties of lycopene remain particularly poorly understood. Further research on the bioavailability, pharmacology, biochemistry, and physiology must be done to reveal the mechanism of lycopene in human diet, and the in vivo metabolism of lycopene.

Consumer demand for healthy food products provides an opportunity to develop lycopene-rich food as new functional foods, as well as food-grade and pharmaceutical-grade lycopene as new nutraceutical products. An industrial scale, environmentally friendly lycopene extraction and purification procedure with minimal loss of bioactivities is highly desirable for the foods, feed, cosmetic, and pharmaceutical industries. High-quality lycopene products that meet food safety regulations will offer potential benefits to the food industry.

LYCOPENE RESEARCH & FINDINGS

- Lycopene is an open-chain unsaturated carotenoid that imparts red colour to tomatoes, guava, rosehip, watermelon and pink grapefruit.
- Lycopene is a proven antioxidant. Antioxidants neutralize free radicals, which may damage the body's cells.
- Research shows that lycopene in tomatoes can be absorbed more efficiently by the body if processed into juice, sauce, paste and ketchup. The chemical form of lycopene found in tomatoes is converted by the temperature changes involved in processing to make it more easily absorbed by the body.
- In the body, lycopene is deposited in the liver, lungs, prostate gland, colon and skin. Its concentration in body tissues tends to be higher than all other carotenoids.
- Regular high consumption of fruits and vegetables is recommended as part of healthy eating. Epidemiological studies have shown that high intake of lycopene-containing vegetables is inversely associated with the incidence of certain types of cancer. For example, habitual intake of tomato products has been inversely associated with the risk of cancer of the digestive tract among Italians. In one six-year study by Harvard Medical School and Harvard School of Public Health, the diets of more than 47,000 men were studied. Of 46 fruits and vegetables evaluated, only the tomato products (which contain large quantities of lycopene) showed a

measurable relationship to reduce prostate cancer risk. As consumption of tomato products increased, levels of lycopene in the blood increased, and the risk for prostate cancer decreased. The study also showed that the heat processing of tomatoes and tomato products increases lycopene's bioavailability.

- Ongoing preliminary research suggests that lycopene is associated with reduced risk of macular degenerative disease, serum lipid oxidation and cancers of the lung, bladder, cervix and skin.
- Studies are underway to investigate other potential benefits of lycopene - including the H.J. Heinz Company sponsored research at the University of Toronto and at the American Health Foundation. These studies will focus on lycopene's possible role in the fight against cancers of the digestive tract, breast and prostate cancer.

* Note! Medical conditions or problems should be discussed with your doctor. Good nutrition is not a substitute for medical treatments and a doctor's care.