



Lycopene

Lycopene belongs to a class of compounds known as the carotenoids, which are the yellow, orange, and red pigments synthesized in plants. Their function in plants is to absorb light in photosynthesis, protecting plants against photosensitization. The five principle carotenoids found in human plasma, as the result of ingesting plants, include alpha and beta-carotene, beta-cryptoxanthin, lutein, and Lycopene. Over 600 carotenoids have been identified to date.



Lycopene Sources

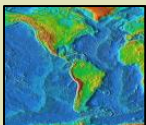
Lycopene is what gives tomatoes, pink grapefruit, watermelon, and guava their red color. It has been estimated that 80% of the lycopene in the US diet comes from tomatoes and tomato products like tomato sauce, tomato paste, and catsup. Tomato and tomato products are the single best source of lycopene. In tomatoes, lycopene content is affected by the specific variety of tomato and by ripening stage. Deep red varieties contain up to 50 mg/kg, while yellow tomatoes may be as low as 5 mg/kg. Bioavailability of lycopene is improved with cooking. Lycopene availability is improved in cooked tomatoes compared to raw. The presence of fat in the diet improves lycopene absorption.

History

Lycopene was largely ignored for decades because of its lack of provitamin A activity, long thought to be the distinguishing characteristic among carotenoids. In the 1960's, during a case study which first documented lycopopenemia, an accumulation of lycopene in the body tissues, the following was said:



"So far little is known. Lycopene is neither toxic nor beneficial, but is only an adventitious visitor to the body. Its failure to form vitamin A may account for its accumulation in the liver."



Lycopene Intake

American lycopene intake averages 3.1-3.7 mg/d, closely matching beta-carotene. In contrast, British intake averages 1.1 mg/d and that for Finns is even lower at .7 mg/d.

Lycopene Content of Selected Foods



| Food | Serving | Lycopene (micrograms) |
|------------------------|----------------|-----------------------|
| Tomato Paste, Canned | 1 cup | 75,362 |
| Tomato Puree, Canned | 1 cup | 54,385 |
| Marinara Sauce | 1 cup | 39,975 |
| Tomato Soup, Canned | 1 cup | 25,615 |
| Vegetable Soup, Canned | 1 cup | 23,337 |
| Tomato Juice, Canned | 1 cup | 21,960 |
| Watermelon, Raw | 1 wedge | 12,962 |
| Tomatoes, Raw | 1 cup | 4,631 |
| Ketchup | 1 tablespoon | 2,551 |
| Pink Grapefruit, Raw | 1/2 grapefruit | 1,745 |
| Baked beans, Canned | 1 cup | 1,298 |
| Sweet red pepper, Raw | 1 cup | 459 |



Biological Activity

Carotenoids are protective against chronic diseases which are thought to be caused by damage from free radicals. Free radicals are molecules with an unpaired electron in their outer atomic orbital, causing the molecule to be extremely reactive. Carotenoids prevent oxidative damage in biological systems, such as damage to the cell membrane and other structures, DNA molecules, lipids, and proteins.



Environmental sources of free radicals include:

- Environmental toxins and air pollutants, such as ozone and nitrogen dioxide
- Sunlight
- Ionizing radiation
- Certain drugs
- Cigarette Smoke





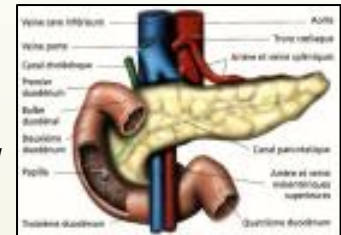
Digestive tract cancers

Esophageal, gastric, and pancreatic

As early back as 1979, researchers in Iran reported that weekly tomato consumption was associated with a 40% reduction in risk for esophageal cancer.

In 1989, a case controlled study of 2,175 participants was conducted in Italy in order to assess the geographic variation in mortality rates from gastric cancer. Tomato products seemed to show a significant inverse relationship with the occurrence of gastric cancer.

In one case–controlled study of 44 matched control subjects and 22 diagnosed cases of pancreatic cancer, it was found that the greatest difference between controls and cancer cases was in serum lycopene concentrations. Researchers found that low serum lycopene was significantly correlated with pancreatic cancer.



Prostate Cancer

There is a strong link between lycopene and prostate cancer. Using the cumulative average of the three dietary questionnaires used in the Health Professionals Follow-Up Study (HPFS), it was determined that lycopene intake was associated with reduced risk of prostate cancer. Intake of tomato sauce, the primary source of bioavailable lycopene, was associated with an even greater reduction in prostate cancer.



Bladder, Cervical, Breast, and Lung cancers

Studies have shown that the risk for bladder cancer increased with decreases in serum levels of both lycopene and selenium. For breast, lung, and cervical cancers, results have been mixed, with some research indicating possible links between lycopene and cervical cancer. The same is true of possible links between lycopene and breast cancer.



Cardiovascular Disease

Oxidative damage is believed to be the underlying mechanism in the etiology of cardiovascular disease (CVD). More recently, the multifaceted role of oxidatively modified LDL has been proposed as being instrumental in atherogenesis. It is believed that, along with vitamin E, carotenoids may function to protect LDL against oxidation. Once vitamin E is depleted, researchers believe that the carotenoids become involved as a second barrier, with LDL succumbing to oxidation only when the carotenoids are destroyed. Currently, much research is being conducted on the role of carotenoids and the development of cardiovascular disease.

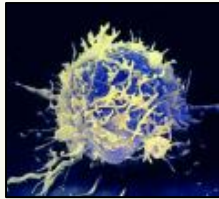


Other

Lycopene has also been linked to functional capacity in the elderly, indicating that deficiencies may significantly decrease self-care ability in affected individuals.



Animal and laboratory studies have shown that carotenoids exert immunomodulatory effects by influencing T and B lymphocytes, natural-killer cells, and macrophages. In patients with HIV infection, even with adequate dietary intake, several had specifically identified carotenoid deficiencies.



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<http://lpi.oregonstate.edu/infocenter/phytochemicals/carotenoids/index.html>

<http://sun.science.wayne.edu/~nfs/dietetics/lyco.htm>

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