

# Plant-based Foods For Chronic Inflammation: A Review

## Combined use of Tomato and Olive Oil facilitates Chronic Inflammation Control.

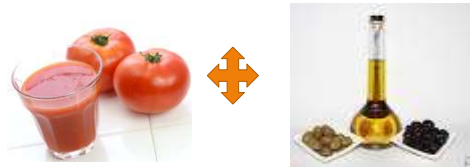
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### HYPOTHESIS

Review and provide evidence on intake of plant-based foods decreases the progression of inflammatory diseases with more focus to discuss the benefits of lycopene and oleocanthal in chronic inflammation control.

### BACKGROUND

Studies have demonstrated consuming plant-based diet improves health through its constituents at the micro and macromolecular level. Chronic inflammatory conditions like cardiovascular, degenerative diseases, cancer, diabetes, etc. lead to polypharmacy and poor quality of life. Consuming plant-based diet rich in polyphenols and carotenoids routinely decreased inflammatory activities in the body and have been reported to reduce morbidity and mortality, decreased inflammation, and regressed progression of cardiovascular, neurodegenerative, and cancer diseases. Here we review evidence on the health benefits of plant-based foods that are rich in "Oleocanthal", a polyphenol compound, and "lycopene", a carotenoid in halting the progression of chronic inflammation.



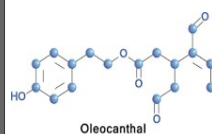
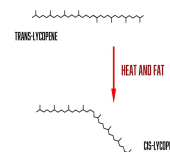
### METHODS

Search engines Pubmed and NIH-National Library of Medicine were used to search with words "health benefits of plant-based foods", "anti-inflammatory benefits" "lycopene", and "oleocanthal" to review the evidence articles. Out of fifty articles reviewed, forty-seven articles provided information on the health benefits of plant-based foods. Here we discuss the benefits of lycopene and oleocanthal and their combined use provided significant additive anti-inflammatory effects.

### RESULTS

Plant-based foods rich in polyphenols and carotenoids contribute to anti-inflammatory activity by modulating pro-inflammatory gene expressions cyclooxygenase, lipoxygenase, nitric oxide synthases, and cytokines, activating nuclear factor-kappa B, and mitogen-activated protein kinase signaling. Trans-lycopene level for each  $\mu\text{mol/L}$  decreased 0.067 mg/dL CRP and 0.048 mg/dL Fibrinogen. Intake of 30mgs lycopene daily caused a 9% reduction in DNA damage. Processed tomato cell matrix enhanced the release and absorption of lycopene more than fresh tomatoes. Thirty minutes of cooking tomatoes released 164% of lycopene when compared to 2 minutes, 54%. Maximum antioxidant activity is from the skin and seeds of tomatoes. Lycopene, a lipid-soluble compound, consumed with oleocanthal from olive oil increased bioavailability and absorption that augmented anti-inflammatory effects. Eighty-two percent of trans-lycopene and 40% cis-lycopene concentration increased when consumed tomatoes with olive oil compared to those without olive oil. Daily intake of 30 mg lycopene or 30 mg of oleocanthal was comparable to 10% of Ibuprofen pain-relieving, anti-inflammatory action.

|                            | Lycopene Content   |
|----------------------------|--------------------|
| Raw tomatoes               | 0.88-7.74 mg/100 g |
| Cooked Tomatoes for 30 mts | 1.44-2.04 mg/100g  |
| Pomegranate                | 0.09 mg/100g       |
| Salad dressing             | 2.0-3.5mg/100g     |
| Watermelon                 | 4.5 mg/100g        |
| Grapefruit                 | 1.5 mg/100g        |
| Papaya                     | 1.7mg/100 g        |



|             | Polyphenol Content                                 |
|-------------|--|
| Olive Oil   | 62 mg/100 ml of polyphenols and 4mg of Oleocanthal |
| Pomegranate | 0.09 mg/100g lycopene and 66 mg of polyphenols     |
| Cloves      | 15,188 mg/100gms                                   |
| Oregano     | 2,300 mg/100g                                      |
| Walnuts     | 0.88-7.74 mg/100 g                                 |
| Grapes      | 1.44-2.04 mg/100g                                  |
| Pecans      | 493 mg/100g  |
| Moringa     | 4.500 mg/100g                                      |

### DISCUSSION

Lycopene a carotenoid with a powerful natural antioxidant property is present in many fruits and vegetables, especially in tomatoes, watermelon, pink grapefruit, pink guava, and papaya. Lycopene are lipid-soluble phytochemicals with an antioxidant, antiapoptotic, and anti-inflammatory properties. By intracellular signaling cascades lycopene influence gene expression, protein translation, and block the translocation of nuclear factor  $\kappa\text{B}$  to the nucleus that interact with the nuclear factor  $\kappa\text{B}$  pathway to inhibit the downstream production of inflammatory cytokines- interleukin-8 or prostaglandin E2.

Olive oil rich with phenolic oleocanthal, a natural nonsteroidal anti-inflammatory compound not found in other cooking oils. Oleocanthal has been reported to exhibit various modes of action in reducing inflammatory-related disease, including joint-degenerative disease, neurodegenerative disease, and specific cancers. Assuming approximately 70% absorption, then 50 mL/day of virgin olive oil corresponds to approximately 10% of the current Ibuprofen pain-relieving dose. Adding olive oil to diced tomatoes during cooking greatly increases the absorption of lycopene and augments the health benefits of lycopene and the oleocanthal. Combining plant-based foods rich with lycopene and oleocanthal components enhance anti-inflammatory benefits and better control of chronic inflammation.

### CONCLUSION

1. Consumption of combined variety of plant-based diet like three to four cooked tomatoes or half a cup of tomato sauce with thirty grams of extra virgin olive oil helped with chronic inflammation and decreased the need for anti-inflammatory medications.
2. Counselling to enhance intake of plant-based diet in the primary care setting can decrease chronic inflammation related polypharmacy use.

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