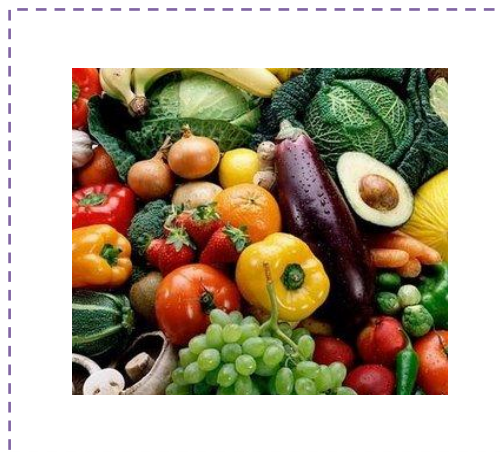


## CAROTENOIDS IN MACULAR HEALTH OF INDIAN EYE

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### WHAT IS CAROTENOID?

Carotenoids are naturally occurring pigments found mainly in plants, algae and photosynthetic bacteria. The red, green and yellow colors are mainly responsible for the presence of these pigments. Chemically, carotenoids include two different classes of compounds: 1) Carotenes - e. g: the active principle that is found in carrot (Beta carotene) and tomatoes (lycopene) 2) Xanthophylls (Oxygenated derivative of carotenes) e. g: lutein and zeaxanthin. Carotenoids not only give attractive colors to the plant leaves, fruits and flowers but also give vibrant colors to some birds, insects, fish and crustaceans. Well known examples for the carotenoids are carrots, beet root, citrus fruits, tomatoes, salmon and flamingoes. In photosynthetic organisms, the carotenoids play an important role in the absorption of light during photosynthesis whereas in non-photosynthetic organisms like yeast and molds, it prevents from causing damage due to light and molecular oxygen (free radicals).



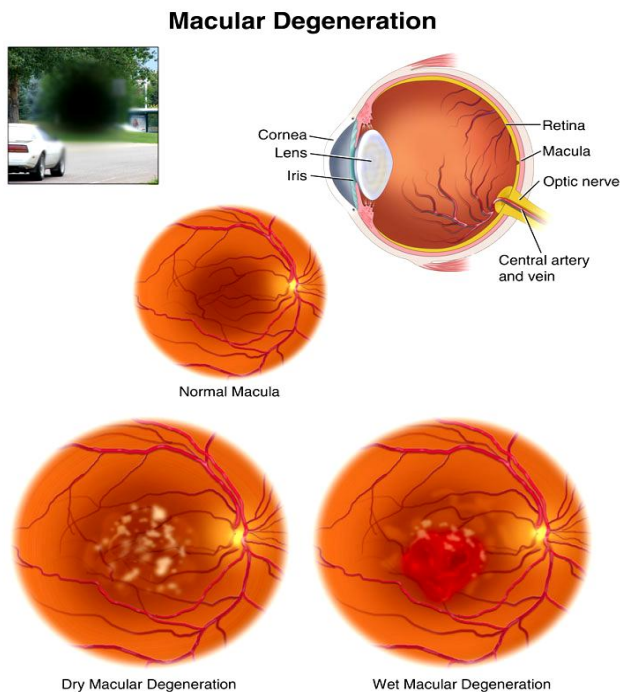
### MACULAR CAROTENOIDS

In humans, the carotenoids are not present naturally and need to be supplemented through diet. Among 600 carotenoids reported 50 are commonly found in food stuff. Among the carotenoids, only **lutein** and **zeaxanthin** gained importance in ocular function. The main dietary sources of Lutein is green leafy vegetables especially dark green varieties such as spinach, broccoli, and lettuce, where as the principal source of Zeaxanthin is yellow corn and other source including oranges, yellow vegetables, alfalfa and marigold flowers. These two carotenoids play a major role in the prevention of age-related macular degeneration and cataract.

The retina of the human eye is the light sensitive tissue located at the back of the eye. The retina instantly converts light images into electrical impulses through a chemical reaction. The retina then sends these impulses or signal, to the brain, where we interpret what we see, process the visual information, and relate what we see to the rest of our environment. In our eye, Lutein- Zeaxanthin is highly concentrated in the central part of the retina called macula. This pigmentation in the macula is completely absent during birth but deepens as we age. Xanthophylls in macula of the eye are believed to perform two important functions: 1) filter blue light and 2) antioxidant to quench and scavenge photo-induced free radicals. Zeaxanthin dominates at the central portion of the macula and lutein at the peripheral retina.

## MACULAR CAROTENOIDS & AGE-RELATED MACULAR DEGENERATION

The macula is a small portion of the retina located in the central portion of the retina. The macula is responsible for central vision (straight-ahead vision) and provides the ability to see fine detail that allows us to read, drive a car, and recognize faces or colors. The non-macular area of the retina is responsible for side vision and best night vision. AMD is an idiopathic retinal degenerative disease leading to blindness in the elderly population (60 years and above) in the Western world. It is not only highly prevalent in western countries but also in India. A major study of our hospital in collaboration with London School of Hygiene and Tropical Medicine, London, UK (INDEYE study, 2011) reported the high prevalence of early stage or late stage of AMD in India. There is a potential link between the pigmentation of carotenoids in macula and age-related macular degeneration (AMD). Many epidemiological studies have demonstrated that dietary supplementation of macular carotenoids have beneficial role in delaying the progression of AMD. AMD occurs when macula, deteriorates over time leading to blurred central field of vision. AMD progresses with early stages described as dry AMD and later stages often referred to as the wet form.



## OUR STUDY ON MACULAR CAROTENOIDS

Traditionally food serves as a good source of essential vitamins and minerals needed for our body. However, the food habits in India are highly influenced by affordability, religious and family sentiments. In one of our study published in journal of Nutritional Studies and Vitaminology (2011) it has been shown that our commonly affordable fruits and vegetables contain good amount of these carotenoids. High amount of lutein (more than  $10\mu\text{g}/\text{gm}$ ) was present in spinach, coriander leaves, mint leaves, bitter guard, snake guard and green chilli. Zeaxanthin content was found to be higher ( $>10\mu\text{g}/\text{gm}$ ) in snake guard, mint leaves and pumpkin. Moreover, our study also

showed that the concentration of cadaveric macular xanthophylls of South Indians are 4 times lower than that of North Indians.

Xanthophylls are known to degrade when subjected to cooking at higher temperatures, therefore the availability of Lutein and zeaxanthin in the staple food of South Indians is doubtful as very little raw vegetables is consumed regularly in their food as compared to of North Indians. To maximize the availability of the carotenoids, certain the food should be eaten raw or steamed lightly. Anyone with, or at risk of developing AMD, should increase their daily intake of lutein and zeaxanthin either through diet, or supplements.