

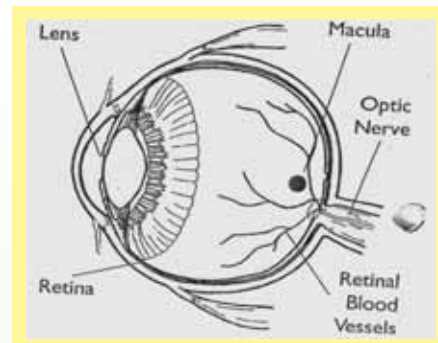
# Vision - Protection of vision

J. RAGUNATH RAO<sup>1\*</sup>, ALEXANDRA SCHMID-RIEDL<sup>2</sup>

Corresponding author

1. Novo Agritech Limited, 93/A, Sagar Society,  
Road no 2, Banjara Hills, Hyderabad 500 034, A.P. India  
jraghunath@novoagri.com

2. Sole Distributor Europe, Fit Ingredients e.K., Albstasse 16  
79639 Grenzach-Wyhlen, Germany  
info@fitingredients.de



Vision is the process of converting light into image signals that the brain can understand. The Macula, a tiny area at the centre of the retina, is the collection of photoreceptor cells, mostly cone cells, responsible for turning light into color image with fine details in the brain. The macula very selectively concentrates lutein and zeaxanthin into a layer of retina tissue that overlies this area of the eye. Early anatomist referred to this area as the macula lutea or yellow spot because of the deep yellow hue of lutein and zeaxanthin. By comparison, the unique concentration of lutein and zeaxanthin in the eye is remarkable.

The selectivity of lutein and zeaxanthin in the eye and their lack of pro-vitamin A activity suggests they could play novel role in eye health. The two functions proposed are their role as an anti oxidant and absorption of near - to - UV blue light. The yellow carotenoids lutein and zeaxanthin specially absorb near-to-UV blue light (blue being the complementary color to yellow). Blue light, especially visible blue light, wave length just above UV spectrum, is the highest energy and potentially most damaging wave length of light that reaches the retina. The way the retina is organized; light must first pass through highest concentration of lutein and zeaxanthin before reaching the sensitive rod and cone cells. As antioxidants, lutein and zeaxanthin can also inhibit the formation of damaging free radicals by quenching singlet oxygen. The free radicals in the tissue are produced under two circumstances - high metabolic activity and the interaction of the energy with the tissue exist in the macula. The metabolic processes which convert light energy into brain signals are very active in the macula, while at the same time, the lens is rightly focusing light to the small area of the tissue. The parts of the retina most susceptible to oxidative damage are the outer segment of the rod cells. This area is rich in polyunsaturated fatty acids that are readily oxidized. Lutein and zeaxanthin are found in significant quantities within these outer segments.

The zeaxanthins extra conjugated double bond may make it a better antioxidant than lutein. The relative importance of light absorption versus the antioxidant properties of lutein and zeaxanthin may dependent on the age. Lutein and zeaxanthin near-to-UV blue light filtering properties may be more important to the younger years when the lens is clear and damaging light can more easily reach the eye, as we grow older, the lens naturally become more yellow and allows less near-to-UV blue light to reach the retina. Like wise, the antioxidant properties of lutein and zeaxanthin may be relatively more important later in life and the body produces far more ROS.

Epidemiological studies have consistently indicated that the consumption of fruit and vegetables is inversely related to the incidence of disease, particularly cancer. The correlation also holds true for the carotenoids, but it is unclear if they are just a marker for consumption of vegetables and fruits, since the majority of carotenoids are derived from these foods. Mammalian species, including humans, do not have the ability to synthesize any of the carotenoids. Although it is recognized that some bacteria can synthesize carotenoids, in the microflora of most animals (except ruminants) occurs in the distal part of the digestive tract where carotenoids absorption is almost non existent. All the carotenoids found in mammalian tissues are therefore derived from dietary sources. The carotenoids generally found in food are all-trans (E) from C40 polyenes formed from eight 5-carbon isoprenoid units. The all-trans structure is frequently subject to isomerization giving a cis- configuration (Z form) such configuration change may have a significant effect on the physical and biochemical properties of the molecule. The hydrocarbon carotenoids are polar lipophilic molecules and show no solubility in water but are readily soluble in organic solvents and to some extent in fats and oils.

In foods that humans consume, several hundred carotenoids have been identified but there are only a few that are ingested in significant (mg) quantities. Lutein is one of the six prevalent carotenoids (including alpha-carotene, beta-carotene, beta-cryptoxanthin, lycopene and zeaxanthin) present in human plasma. Lutein and zeaxanthin are oxygenated carotenoids known as xanthophylls.

Lutein has a strong history of scientific evolution. Two researchers separately found that lutein can be converted in the blood serum into zeaxanthin. In 1994, a researcher at Harvard University published a study in the journal of the American Medical Association that a daily intake of six mg lutein led to a 43 percent lower prevalence of contacting age-related macular degeneration (AMD or ARMD). Mexican varieties of marigold flower (*Tagetes erecta*) is the richest source of lutein and its isomer zeaxanthin. They naturally exist in the flower in ester form, normally as acetyl (palmitate) ester. Lutein and zeaxanthin usually found together are occur the macular region of the eye. Both carotenoids make up what is referred to macular pigment and according to the experts, these are the only two carotenoids present in majority of the tissues in the eye. The carotenoids protect the eye from oxidative damage and filter out damaging near-UV blue light. Most of the studies on lutein and zeaxanthin revolve around the consumption of these two carotenoids in fruits and vegetables with reduced incidence of eye related illnesses. The low consumption of these both carotenoids may increase the risk of developing eye related diseases. When we look at the market for eye health in terms of the spectrum of carotenoids, lutein always plays a central role. But lutein does not work alone. According to experts the lutein has been the main focus because of two factors: 1) Lutein can be metabolized into zeaxanthin and is therefore the most essential carotenoid. 2) Both lutein and zeaxanthin are the only two carotenoids present in the tissues of the eye and therefore both are important in maintaining eye health. Some studies indicate that zeaxanthin may slightly be a better antioxidant than lutein, it is present in the centre of the Macular and as part of the macular pigment, it might help protect the eye against oxidative damage.

The growing popularity of lutein and its inclusion in Centrum multivitamins will cause a lot of multivitamins eventually re-formulate. Consumer awareness is growing all over the place; however, they need to know more of the interesting developments. Physicians are not in tune with the nutraceutical industry and patients must turn elsewhere to get the right information.

Since the body cannot make its own lutein and since people don't eat enough green leafy vegetables, supplements are imperative. Lutein in supplement form was compared to spinach food and the study concluded that the supplement form had two times higher bioavailability and nutrients from supplements have more bioavailability than ingredients from food. That is a key point. Supplementation from natural mixed carotenoids provides a natural bridge for those who do not consume enough fruits and vegetables.

## ANTIOXIDANT AND LIGHT FILTERING PROPERTIES OF LUTEIN AND ZEAXANTHIN

Lutein and zeaxanthin specifically absorb near-to-UV blue light (blue being the complementary color to yellow). Blue light especially visible blue light wave lengths just above the UV spectrum is the highest energy and potentially most damaging wave length of light that reaches the retina.

The way the retina is organized, light must first pass through the highest concentration of lutein and zeaxanthin (in Henle's fiber layer) before reaching the sensitive rod and cone cells. As antioxidants, lutein and zeaxanthin can also inhibit the formation of damaging free radicals by quenching single oxygen. Two circumstances that can produce free radicals in a tissue - high metabolic activity and the interaction of energy with tissue both exist in the macula. The metabolic processes which convert light energy into brain signals are very active in the macula, while at the same time, the lens is tightly focusing light on this small area of tissues. The parts of the retina most susceptible to oxidative damage are the outer segments of the rod cells. This area is rich in polyunsaturated fatty acids that are readily oxidized. Recent studies indicate that lutein and zeaxanthin have been found in significant quantities within these outer segments. In addition, *in vitro* evidence suggests that zeaxanthin's extra conjugated double bond may make it a better antioxidant than lutein. The relative importance of the light absorption versus the antioxidant properties of lutein and zeaxanthin may depend on age. For example, lutein and zeaxanthin's near-to-UV blue light filtering properties may be more important in younger years when the lens is clear and damaging light can more easily reach the eye. As we grow older, the lens naturally becomes more yellow (brunescence) and allows less near-to-UV blue light to reach the retina. Likewise, the antioxidant properties of lutein and zeaxanthin may be relatively more important later in life when the body produces far more ROS.

## CAROTENOIDS AS ANTIOXIDANTS

An antioxidant is a molecule that protects against damaging reactive oxygen species (ROS). Singlet oxygen and peroxide radicals are two ROS that arise from normal reactions in the body or exposure to cigarette smoke, air pollutants, radiation, certain drugs and environmental toxins. Either species may react with change of DNA, protein or lipids and impair their physiological function. It is believed that these reactions with ROS can be the initial events in the pathogenesis of diseases such as cancer, cardiovascular disease and age-related macular degeneration. Carotenoids deactivate singlet oxygen by physical or chemical quenching. The efficiency of quenching depends upon such molecular properties of the molecule as the number of double bonds, the type of end groups or other chemical groups found in carotenoids.

Novopure brand natural lutein esters are extracted from marigold flowers - a rich and safe source of lutein. Novopure natural lutein esters are distinctive and compared to other products. Novopure natural lutein available in the market differs in the composition with other products, though they are the same in one important aspect. Both provide lutein to the body which has a critical role in the promotion of health vision. However, the advantage of lutein ester is that the body readily uses and converts naturally. Lutein esters are digested and absorbed like other dietary fats. They enter the intestine where a complex digestion and absorption process takes place. Novopure natural lutein ester is the same as the lutein esters found in yellow and orange fruits and vegetable such as: oranges, peaches, papayas, peppers and squash. These lutein esters are converted naturally by the human body to lutein. Research demonstrates this lutein is identical to lutein supplied directly to the body from green leafy vegetables. The body does not produce lutein, so dietary supplement is prudent *i.e.*, because most people do not consume enough fruits and vegetables to reach the level we need for good health. The bio availability of lutein and lutein ester supplements has become controversial. However, more human intervention studies have been published up to date on lutein ester supplements than lutein supplements. Several research studies have confirmed that when lutein esters are consumed blood lutein levels increased. These studies show a dose-response effect - the more lutein ester consume, the greater the blood lutein levels. Research have shown that plasma lutein level increased five-fold with a daily dose of 20 mg natural lutein ester equivalent to 10mg free lutein. This study also establishes that lutein ester gets absorbed in the blood stream but also increased the density of macular pigment. Researchers also found that lutein from natural lutein esters retained in the blood four weeks after the participants stop taking the supplements. In the month after the study was finished blood lutein levels were one and half times higher than at the beginning of the study. This means that the lutein from natural lutein ester is maintained in the body and can provide continuous health benefits.

A recent study demonstrates a link between natural ester supplements and increased macular pigment density. The tissue with normal carotenoid deposit aids detailed vision and by filtering out harmful blue wave lengths of light may protect the underlying eye components. A greater density of macular pigment is associated with a greater likelihood of maintaining healthy vision. In addition, lutein and zeaxanthin are known to possess antioxidant activity that may reduce the level of damaging free radicals in the eye. The eye retina and lens have a risk of oxidation from free radicals induced by the sun light. Oxidative damage has been shown to affect healthy vision. As an antioxidant in the body lutein from natural lutein ester fight against free radicals caused by oxidative stress. The excellent qualities found in Novopure natural lutein ester are due in part to the supercritical CO<sub>2</sub> extraction process technology adopted under global patent. This patented process technology serves as quality control of Novopure lutein ester. The natural lutein ester product when ingested goes through a natural hydrolysis process in the body that splits the ester bond releasing the lutein from lutein ester. Human clinical studies proved the consumption of lutein ester results in higher lutein blood level clearly demonstrating that hydrolysis of lutein esters and lutein absorption takes place. In the manufacture Novo maintains the natural integrity of the marigold flower pigments that are natural luteins esters. Novopure natural lutein esters are converted to lutein naturally by the human body.

Novopure natural lutein esters have excellent stability and is a premium product competitively priced.

The advantages of using Novopure lutein ester products are:

1. Excellent bioavailability through natural conversion by human body
2. Proven retention
3. Patented extraction process and product extracts
4. High stability
5. Competitive price

As powerful antioxidants carotenoids help from the bodies defenses against free radicals that are associated with a variety of health issues.