International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 10, Issue 2 -2023

Review Article

DOI: http://dx.doi.org/10.22192/ijarbs.2023.10.02.007

Review article On The Role Of Lutein On Aged-Related Macular Degeneration (AMD)

***Priti Sunil Sawardekar**
M.Ssc.. Food Technology

Abstract

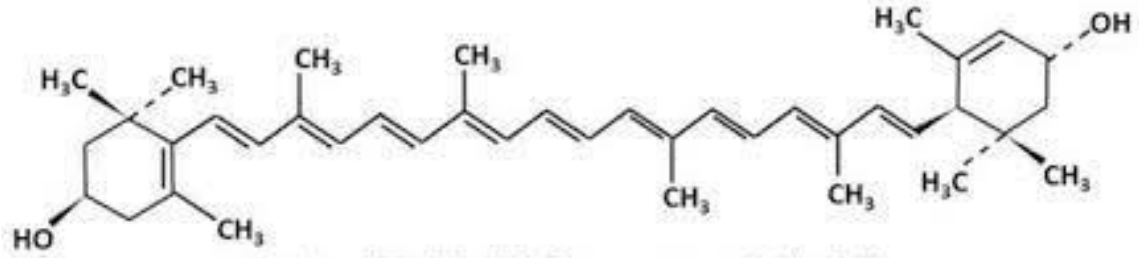
The present work was aimed to target specially the role of pigment on eye health according to the old age which commonly occurs nowadays mainly AMD (Age-related Macular degeneration.). The eye is one of the major sensory organ which also requires special care for healthy lifestyle. Lutein is a lipid-soluble or we called fat-soluble which is not soluble in water. L is one of the carotenoid that have anti-inflammatory properties. Lutein and Zeaxanthin are basically two carotenoids present in human's eye located in retina specially at macular region. Therefore, L & Z are also known as macular pigments. AMD is a type of disease which is not treatable, approx 90% of the patients and after sometimes it is lead to blindness. AMD are of basically two types on the basis of presence or absence of blood vessels i.e. Dry AMD and Wet AMD. The study also includes the synthesis of Lutein, its absorption, and how Llutein affects the health of the eye.

Keywords: L= Lutein, AMD=Age-related Macular Degeneration, Z=Zeaxanthin, MP=Macular pigment

Introduction

Nutrition is crucial to human health, and the eye is no different. Healthy eyes provide clear vision, which is necessary for life. Health issues regarding eye health are becoming more widespread over the world**.** Our eyes require a variety of nutrients in different forms for optimal health. One of the important nutrients for eye health is lutein, and carotenoid that has anti-inflammatory properties. Carotenoids are nutrients widely distributed in foods and have antioxidant properties. Carotenoids are naturally abundant in fat-soluble pigments. Lutein is the most found abundant carotenoid in the eye and brain. Structurally Lutein, like all carotenoids, has a backbone which is made up of conjugated carbon double bonds. Lutein may aid in the prevention of age-related eye illnesses such as age-related macular degeneration and cataracts or Colour Blindness or we also call night blindness which is majorly affected by Vitamin A deficiency. Age-related macular degeneration is an eye disease which leads to vision loss in old age people .Percentage of main carotenoids found in human serum is lutein (20-22%) lycopene (19-21%), β-carotene (10-12%); α-carotene (5-8%), and zeaxanthin (2-3.5%). Excessive nutritional

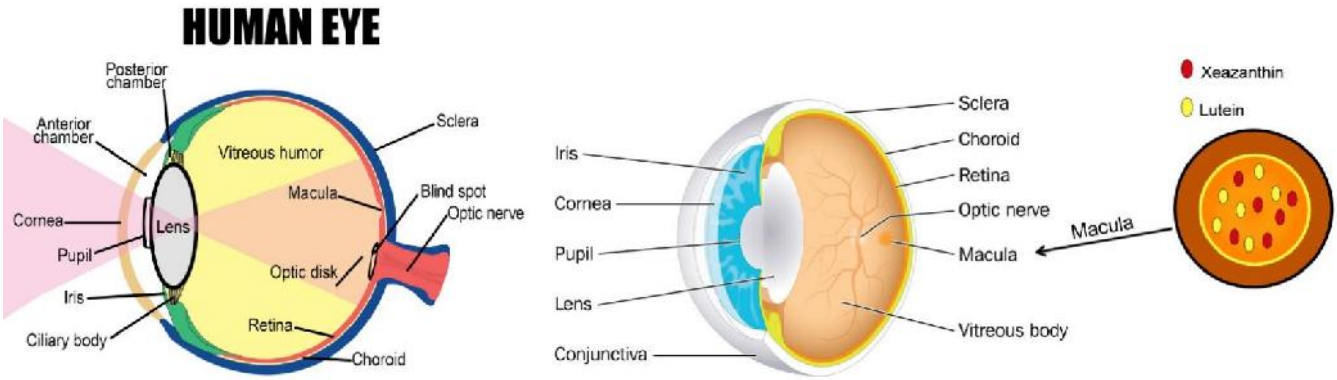
consumption of carotenoids has been related to the anti-inflammatory properties which boosts the immune system, and also plays the major role in cardiovascular disease. Carotenoids are vitamins broadly distributed in foods, specifically in fruit and green leafy vegetables which are responsible for the colors visibility such as red, orange, and yellow. Lutein is a xanthophyll, or oxygenated carotenoid found in mammals, including humans, get from their diet because they can't make carotenoids. A high L intake, either from diet or as a nutritional supplement, has been found in several studies to have favorable health effects on eye problems such as preventing or even treating age-related macular degeneration (AMD) and cataracts. Lutein has a skeleton which is made up of 40 carbon atoms that are arranged into eight isoprene units which is similar to that of other carotenoids.



Lutein, (3R,3'R,6'R)-β,ε-carotene-3,3'-diol)

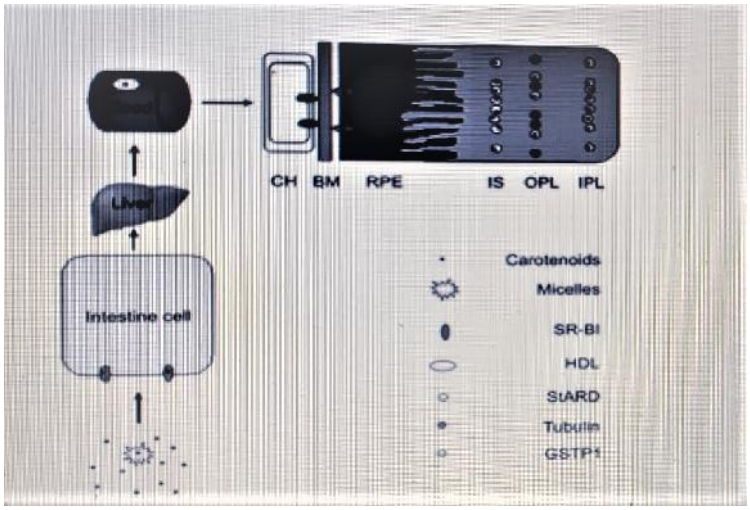
Macular pigments are the yellow pigments which includes meso-zeaxanthin (MZ), lutein (L), and zeaxanthin (Z) that are found in the macula. The macula is the posterior pole of the retina. The macula of the retina contains the highest concentration of L and Z, approx.the concentrations are 100 times higher than any other parts in the eye [Lutein and Zeaxanthin Isomers in Eye Health and Disease]. The concentration of lutein in the macula is roughly 2.5 times higher than in the peripheral retina.[Effects of lutein supplementation in age-related macular degenerate]

The macula contains lutein, which filters blue light, neutralizes free radicals, and helps to maintain vision. As a result, lutein could help prevent age-related eye illnesses like macular degeneration and cataracts. [Effects of lutein supplementation in age-related macular degeneration]



Absorption Of Lutein

Mammalians are not capable of synthesizing carotenoids, therefore should be consumed with meals. L is absorbed by the small intestinal mucosa and bound to chylomicrons (also known as ultra low density lipoprotein), after which it is released into the lymph and reaches the liver. L is converted into lipoproteins in hepatocytes cells and then transported to peripheral organs, particularly in the retina. Due to lutein's lipophilic nature, it needs to be included in combined micelles before absorption. Carotenoids in combined micelles are absorbed through the intestinal cells through passive or facilitated absorption



[What do we know about the macular pigment in AMD: the past, the present, and the future]

Factors affecting the absorption

- Nature of food matrix
- Amount and nature of dietary fat (which helps insolubilization of released carotenoids
- Nature of carotenoids.
- Conversely, iron, and zinc levels as well as protein deficit, may also affect L absorption.
- Orlistat, a drug that inhibits lipase activity, has been lead to lower L absorption.

[The Effect of Lutein on Eye and Extra-Eye Health],[Dietary Sources of Lutein and Zeaxanthin Carotenoids and Their Role in Eye Health]

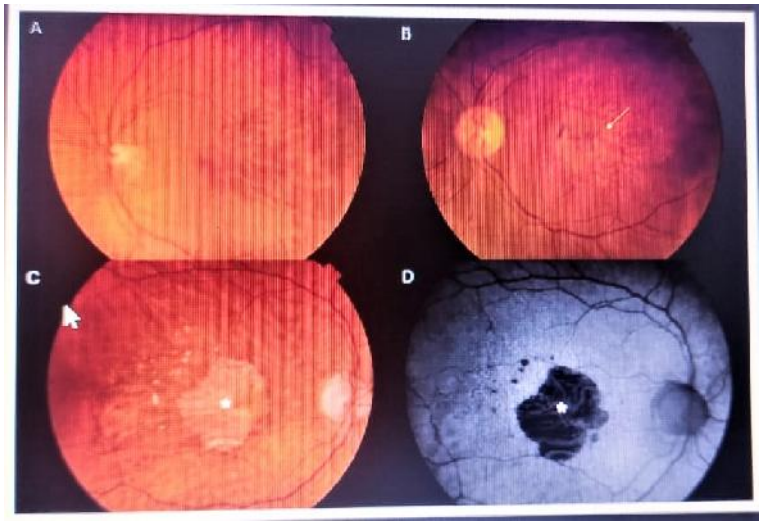
Dietary source

Chicken egg yolk has been considered as a rich source of lutein. The bioavailability of lutein in chicken egg yolk is high because of its high-fat content. In animals, lutein is also particularly determined in egg yolk, fish pores, skin and shell of crustaceans. The ratio of lutein and zeaxanthin in green vegetables (spinach, lettuce, broccoli, etc.), has been referred to range almost 12 to 63%. [Dietary Sources of Lutein and Zeaxanthin Carotenoids and Their Role in Eye Health]. In high-lutein wheat species, the lutein content approx from 5.2 to 7.5 g, while corn contains about 21.7 g. [Dietary Sources of Lutein and Zeaxanthin Carotenoids and Their Role in Eye Health].

Food	Moisture(gm)	Energy(kcal)	Protein(gm)	Fat(gm)	Iron(mg)
Fenugreek Leaves	86.1	49	4.4	0.9	1.9
Spinach	92.1	26	2.0	0.7	1.1
Carrot	76	77	5.1	0.5	8.8
Cauliflower	80	66	5.9	1.3	40
Broccoli	90	34	4.3	0.6	1.5

[Role of lutein and zeaxanthin in visual and cognitive function throughout the lifespan]

Age-Related Macular Degeneration (AMD)



AMD is a degenerative process of the macula and is the main cause of blindness among people age 65. Age-related macular degeneration (AMD) is a widespread, chronic, progressive illness that affects the elderly and results in loss of central vision due to abnormalities in the macula.[Lutein and Zeaxanthin—Food Sources, Bioavailability and Dietary Variety in Age-Related Macular Degeneration Protection]

There are two major types of AMD- Dry AMD & Wet AMD

Dry AMD-The majority of people who have AMD have dry AMD. This occurs as the macula tends to thins with age. There are three stages of dry AMD-Early, Middle, and Late and normally takes several years to progress. There's no treatment for late dry AMD

Wet AMD is a less common type of late AMD that causes faster vision loss. Any of the stage of dry AMD can lead into wet AMD. Treatments are available for this type. The important risk factors for AMD are age, sunlight exposure, cigarette smoking, and poor nutritional status, high-fat diet. [Age-Related Macular Degeneration]. AMD is caused as the yellow cholesterol-rich substance called Drusen which deposits between the retinal pigment epithelium (RPE) cells and the underlying layer of blood vessels. Drusen acts like an obstacle to the retina from excreting waste and receiving necessary nutrients from the underlying blood vessel.

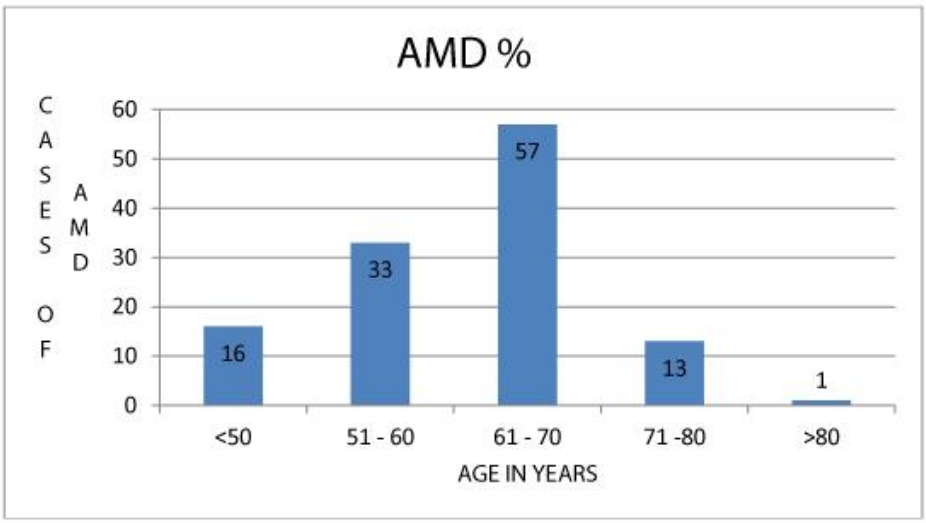
Symptoms

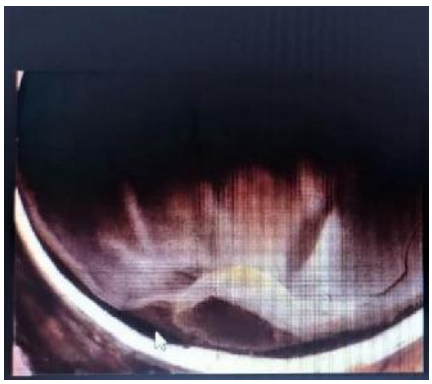
- Visual distortions, such as straight lines seeming bent
- Reduced central vision in one or both eyes
- The need for brighter light when reading or doing close up work
- Increased difficulty to low light levels, such as when entering a dimly lit restaurant
- Increased blurriness of words
- Difficulty recognizing faces

Causes of AMD

Factors that cause risk of AMD can be classified as- 'Personal' and 'Environmental'(e.g.- smoking, sunlight exposure, and nutritional factors such as dietary intake, and alcohol consumption).Personal factors further can be categorized as-

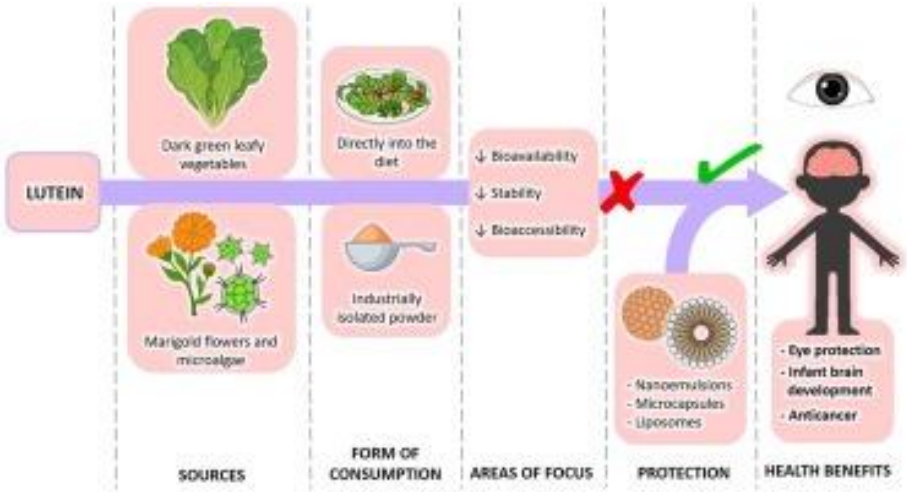
- Sociodemographic (age, sex, race, heredity, and socioeconomic status)
- Ocular (iris color, macular pigment optical density, cataract, and its surgery)[AGE-RELATED MACULAR DEGENERATION]
- Smoking - Macular degeneration is increased by smoking cigarettes or being exposed to frequent smoking.[Smoking and Age-Related Macular Degeneration: Review and Update]
- Diet - Early-stage AMD requires anti-oxidant, vitamins and other nutritional supplements. Getting more antioxidants such as Vit E, Vit C,Zinc and L, where aslack of such antioxidants causes AMD.





Dietary Intake Of Lutein

As per the current status the only treatments for early-stage AMD are anti-oxidant vitamins and other nutritional supplements, together with some changes in lifestyle such as losing weight and stop smoking. Antioxidant vitamins including A, C, and E, as well as the minerals zinc and selenium also play the major role. Lutein is abundant in fruit, cereals, and greens, and is also found in egg yolk. It is been observed that 10 mg of lutein and 2 mg of zeaxanthin were found to be beneficial in slowing down the effect of AMD.



Other factors affecting the lutein content

Cooking, slicing, blanching, canning, freezing, and packaging are the some of the processes which is carried out before consumption. Some of these processing methods have adverse effect on lutein as well. According to the studies, methods such as freezing and blanching reduce the total lutein concentration.

Blanching is a heat-based process that causes lutein breakdown. Canning reduces the content of trans-lutein, as the heat treatments have a strong tendency to isomerize. On the other hand, the freezing temperature tends to keep lutein stable throughout preservation technique .Fruits with higher moisture content, such as guava, cashew, and jackfruit, have lower lutein content. .[Lutein as a functional food ingredient: Stability and bioavailability]

Results

Lutein is almost present in all the green leafy vegetables according to the study. L is the carotenoid having an anti inflammatory properties especially having an health benefit of eye health. Do not take more than 20mg per day of L content. L supplements should be avoided by the pregnant women, lactating women, and children. The fenugreek leaves is the major source of L content, therefore it contains 86gm moisture content, 49kcal energy, 4.4g protein and 1.9gm Iron. Another rich source of l is Broccoli that is 90g moisture, 34kcal energy, 4.3gm Protein, 0.6gm Fats and 1.5mg Iron according to the RDA(recommended Dietary Allowances).

Conclusion

Lutein is an effective antioxidant that has been resulted as progressive and effective eye fitness. . Lutein acts as antioxidant, anti-inflammatory, and blue light-absorption phenomenon. On the other hand Lutein is also known as "eye vitamin". Increased age is the maximum effect of developing an eye disorders like cataracts and AMD. Life style, smoking, heredity and other disorders can also lead to AMD. Obesity increases the risks of AMD because of biological reasons such as it is being linked to increasing adiposity on macular carotenoid distribution in the body.

Lutein contain is obtained mainly from green leafy vegetables and egg yolk. Lutein is also useful in some therapeutic conditions, including improvement of cognitive functions, lowering cancer risk and improving cardiovascular health conditions. It acts as a light filter, protecting the eye tissues from the harmful effects of sunlight. One or both eyes may be affected by AMD but it cannot be recognized as the good or healthy eye may exist for the functioning of weak eye. This ignorance may lead to severe conditions of eye vision functioning leading AMD, Cataract or night blindness.

References

Articles

Dietary Sources of Lutein and Zeaxanthin Carotenoids and Their Role in Eye Health

[1] https://www.webmd.com/eye-health/macular-degeneration/age-related-macular-degeneration-overview
[2] https://www.ncbi.nlm.nih.gov/pmc/articles / PMC6164534/
[3] https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC6936877/
[4] https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC5331551
[5] https://www.sciencedirect.com/science/ article/pii/S1756464619306954
[6] https://pubmed.ncbi.nlm.nih.gov/29576617/ - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3708350/ -
[7] https://pubmed.ncbi.nlm.nih.gov/23571649/-
[8] https://pubmed.ncbi.nlm.nih.gov/22465791/
[9] https://pubmed.ncbi.nlm.nih.gov/11361022/

Websites

https://www.healthline.com/health/lutein-for-eyes
https://www.mayoclinic.org/diseases-conditions/dry-macular-degeneration/symptoms-causes/syc-20350375
https://my.clevelandclinic.org/health/diseases/15246-age-related-macular-degeneration
https://en.wikipedia.org/wiki/Macular_degeneration
https://www.verywellhealth.com/can-lutein-supplements-protect-your-eyes-89060

Access this Article in Online	
	Website: www.ijarbs.com
Quick Response Code	Subject: Health Sciences
DOI:10.22192/ijarbs.2023.10.02.007	

How to cite this article:
Priti Sunil Sawardekar. (2023). Review article On The Role Of Lutein On Aged-Related Macular Degeneration (AMD). Int. J. Adv. Res. Biol. Sci. 10(2): 52-58.
DOI: http://dx.doi.org/10.22192/ijarbs.2023.10.02.007