



Effect of Dietary Carotenoids and Lutein on Eye Health Maintenance in Elderly People

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Abstract: This study aimed to explore the maintenance effect of dietary carotenoids and lutein on the eye health of elderly people. By analyzing the types and characteristics of carotenoids, as well as the characteristics of lutein and its interaction with carotenoids, we have studied their mechanism of action in eye health. Further, we discussed in detail the specific effects of dietary carotenoids and lutein on the eye health of older people, including the prevention of macular degeneration and other senile eye diseases, the improvement of vision, and the impact on light sensitivity. In order to help the elderly effectively take in these nutrients, we provide suggestions on the selection and use of foods containing carotenoids and lutein, as well as suggestions and precautions for dietary plans. Finally, through a case study, we show the positive impact of adopting good diet and supplement strategies on eye health in a real case.

Keywords: the elderly; eye health; carotenoids; lutein

1. Introduction

With the aggravation of population aging, the eye health problems of older people have attracted widespread attention. In this context, more and more studies have focused on carotenoids and lutein rich in food, and explored their potential role in maintaining the eye health of the elderly. This article will introduce the types, characteristics and the mechanism of action of carotenoids and lutein in eye health in detail, and in-depth analyze the specific impact of these nutrients in the diet on the eye health of older people. By providing practical and feasible intake methods, we aim to provide beneficial guidance for the maintenance of eye health in older people.

2. Characteristics and mechanism of carotenoids and lutein

2.1 Types and characteristics of carotenoids

Carotenoids are a class of pigments widely found in plants, mainly including β - Carotene α - Carotene γ - Carotene and other types. The content of each kind of carotene in food is different, and its characteristics are mainly manifested in antioxidant properties and the precursor role of vitamin A. β - Carotene, especially common in food, is considered to be a key component of eye health because it can be converted into vitamin A and is essential for the process of visual transmission [1].

2.2 Characteristics of lutein and its interaction with carotenoids

Lutein, as the decomposition product of chlorophyll, has unique characteristics, especially showing a synergistic effect in the interaction with carotenoids. Firstly, lutein is mainly found in the leaves of plants and is one of the products of chlorophyll degradation during photosynthesis. The special pigment complex in the eye formed with carotenoids provides a unique protective mechanism for the eye. This pigment complex shows special selectivity in the process of absorbing light. The characteristics of lutein enable it to absorb light in the high-energy spectral region, especially blue light and ultraviolet light. This property is crucial to the health of the eye, because light in the high-energy spectral region is easy to cause light damage to eye tissues, especially the macular region. By absorbing these harmful light, lutein helps reduce the light damage to the eyes, thus helping to prevent the occurrence of eye diseases. The study further showed that there was a synergistic effect between lutein and carotenoids. This synergy may be reflected in many aspects. First, carotenoids such as β - Carotene is converted into vitamin A in the eye and participates in the synthesis of visual pigments, which is essential for the normal function of the retina. Lutein cooperates with this process and may help maintain the stability and normal level of vitamin A. Second, another aspect of the synergy between lutein and carotenoids is cooperation in antioxidant defense. Carotenoids and lutein have antioxidant properties, which can neutralize free radicals in the body and reduce the damage of oxidative stress to ocular tissues. This synergistic antioxidant effect helps to maintain the cell structure and function of the eye and reduce

the risk of ocular diseases.

2.3 Mechanism of carotenoids and lutein in eye health

The mechanism of these two nutrients in eye health is multifaceted. First, carotenoids participate in the synthesis of visual pigments and maintain the normal function of the retina by converting them into vitamin A. Secondly, lutein helps prevent eye diseases such as macular degeneration by filtering harmful light and reducing light induced oxidative stress. The synergy of the two can comprehensively improve the adaptability of the eyes to the external environment and reduce the risk of eye aging.

3. Specific effects of dietary carotenoids and lutein on eye health in older people

3.1 Prevention of macular degeneration and other senile eye diseases

Carotenoids and lutein play an important role in preventing macular degeneration and other senile eye diseases. Macular degeneration is one of the common eye diseases in the elderly, which is mainly caused by the degeneration of the central area of the retina (macula), resulting in the loss of vision. Carotenoids, especially β -Carotene, as a powerful antioxidant, can reduce free radical damage in ocular tissues, thereby reducing the risk of macular degeneration. Lutein is directly present in the macular region, helping to filter harmful blue and ultraviolet light and protect the eyes from light damage. In addition, these nutrients can also improve the blood circulation of the retina, provide necessary nutrients, and help prevent other age-related eye diseases, such as cataract [2].

3.2 Improve vision and sensitivity to light

Carotenoids and lutein are essential for maintaining and improving the vision of older people. β -Carotene is converted into vitamin A, which helps to form visual pigments and is the key to the normal function of retinal photoreceptor cells (rod and cone cells). An adequate supply of vitamin A is essential for night vision and overall visual acuity. Lutein is helpful to improve the adaptability of eyes to light and improve light sensitivity, especially in strong light environment. These nutrients can also reduce eye fatigue and enhance the ability to recognize details, thus effectively improving the overall visual performance of the elderly.

3.3 Comprehensive effects of long-term intake on eye health

Long term intake of carotenoids and lutein has a comprehensive positive impact on the eye health of older people. Long term intake of these nutrients can not only help prevent eye disease, but also chronically improve and maintain vision. They have long-term positive effects on slowing down the aging process of ocular tissues, especially on the protection of retina and lens. In addition, the anti-inflammatory and antioxidant properties of carotenoids and lutein help reduce ocular inflammation and oxidative stress, which are particularly important for the prevention and management of chronic ocular diseases, such as glaucoma and retinopathy. Long term balanced intake of these nutrients, combined with a healthy lifestyle, will help maintain the eye health and overall quality of life of older people.

4. How to effectively ingest through diet and supplements

4.1 Foods containing carotenoids and lutein

Dark green vegetables such as spinach, kale, cabbage and mustard are not only rich in lutein and carotenoids, but also rich in fiber, vitamins and minerals. They are a good source of food to maintain eye health. For example, spinach contains large amounts of lutein and zeaxanthin, which help protect eyes from UV and blue light damage. Cabbage and mustard contain not only these nutrients, but also a lot of vitamins C and E. these are powerful antioxidants that help reduce oxidative stress to the eyes. The fiber of these vegetables also helps maintain good digestion and health, thus promoting the absorption of nutrients. Colorful vegetables, such as carrots, pumpkins, sweet peppers and tomatoes, are rich in β -Known for carotene and other carotenoids. For example, carrots are β - It is an excellent source of carotene, which can be converted into vitamin A in the body and is essential to maintain good vision. Pumpkin and sweet pepper contain not only carotenoids, but also other antioxidants, such as vitamin C, which help protect eyes from free radical damage. Lycopene in tomatoes is also a powerful antioxidant that helps reduce the risk of eye disease [3].

Egg yolk in eggs is a good source of lutein, which is particularly effective for protecting eye health. Egg is a comprehensive nutritional food, containing high-quality protein, vitamin B12, selenium and cholesterol. Lutein in egg yolk is particularly important for filtering harmful light and reducing the risk of light damage, and is very beneficial for preventing macular degeneration and other senile eye diseases. In addition, eggs are also a good source of vitamin D and omega-3 fatty

acids, which have a positive impact on overall health. Citrus fruits such as oranges and lemons, and fruits such as mangoes and peaches are rich in carotenoids, which help improve the body's absorption of vitamin A. Vitamin C in these fruits is also a powerful antioxidant that helps protect eyes from oxidative damage. The fiber and water they contain are also important for maintaining body water balance and digestive health. In addition, a variety of trace elements and other nutrients in these fruits have significant positive effects on overall health and eye health. Seafood, especially salmon and shrimp, contains lutein and carotenoids, which are important food sources to maintain eye health. Salmon is also rich in omega-3 fatty acids, which are important for reducing ocular inflammation and protecting retinal health. Shrimp and other seafood contain not only lutein, but also important trace elements, such as zinc and selenium, which are indispensable nutrients for eye health. Regular consumption of these seafood can help protect eyes from aging and environmental factors.

4.2 Recommendations for the selection and use of supplements

When choosing supplements, it is important to give priority to the reputation of manufacturers and product quality. Select those brands that have passed the certification of third-party institutions such as the United States Pharmacopoeia (USP), international non pharmaceutical ingredient certification (nsfinternational) or consumer lab. These certifications mean that the product has been independently tested to verify the accuracy, purity and potency of its ingredients. In addition, transparent ingredient labels can help consumers understand the exact ingredients and doses they are ingesting, ensuring that no potentially harmful fillers or artificial additives are added. Studying and understanding brand reputation, reading user reviews and feedback, can also provide additional information to help make informed choices. Search for carotenoids containing multiple types (e.g β - Carotene, lutein, and zeaxanthin) compound formulation is essential because these ingredients have synergistic effects in maintaining eye health. Some high-quality supplements may also contain other ingredients beneficial to eye health, such as vitamins C and E, which act as antioxidants and help protect eyes from free radicals. Zinc is another important trace mineral, which is essential for maintaining retinal health, while omega-3 fatty acids help reduce ocular inflammation and promote ocular blood circulation. Choosing such a composite formula can more comprehensively support eye health [4].

It is important to follow the dose guidelines on the label or the doctor's recommendations to ensure the safe and effective use of supplements. Although excessive intake of carotenoids is relatively rare, long-term large intake may lead to slight yellowing of the skin, which is caused by excessive carotenoid accumulation in the body. Although this is not a health problem, it may cause concern. Understand the recommended daily intake of each ingredient and ensure that these limits are not exceeded. If you have any questions or concerns, seek professional medical advice. Before starting any supplements, especially if you are taking other drugs or have chronic health problems, it is essential to have a full discussion with your doctor. Certain supplements may interact with specific drugs or affect certain health conditions. By discussing with your doctor, you can ensure that the supplements you choose are suitable for your personal health condition and avoid potential side effects or interactions. Carotenoids and lutein are fat soluble nutrients, and their absorption rate is affected by the fat content in food. Therefore, taking these supplements with foods containing a certain amount of fat can significantly improve their absorption rate in the body. For example, taking with foods rich in healthy fats, such as avocado, nuts, or fish rich in omega-3, can increase the bioavailability of these nutrients. This approach ensures that you get the greatest health benefits from supplements. Supplementation with carotenoids and lutein may take some time to accumulate in the body to levels sufficient to produce significant effects. Therefore, long-term adherence is the key. The positive effects of these nutrients, such as protecting vision and reducing the risk of eye disease, usually take some time to manifest. Taking it regularly and adjusting it according to the manufacturer's instructions or the recommendations of medical professionals can ensure long-term protection of eye health. At the same time, regular monitoring of your health and attention to any changes can help evaluate the effect of supplements.

4.3 Suggestions and precautions for dietary plan

Advice: make sure your diet contains a variety of foods rich in carotenoids and lutein. For example, eat a variety of colorful vegetables and fruits every day, such as dark green vegetables, carrots, sweet peppers, tomatoes, citrus fruits and berries. In addition to focusing on carotenoids and lutein, we should also ensure that the diet contains enough protein, healthy fat, fiber, vitamins and minerals. Because carotenoids and lutein are fat soluble, when eating foods rich in these nutrients, adding some healthy fats, such as olive oil, nuts or fish, can help improve their absorption. Developing a regular meal plan that includes foods rich in lutein and carotenoids can help ensure that your diet always contains these important nutrients.

Caution: some cooking methods may reduce the nutrient content of food. For example, overcooking may reduce carotenoid content in vegetables. Try to use cooking, roasting or light frying methods. Avoid relying on a single food source. Although some foods, such as carrots and spinach, are excellent sources of carotenoids and lutein, a diverse diet ensures a

comprehensive intake of nutrients. Try to choose fresh ingredients as long storage time may reduce the content of nutrients. Frozen vegetables are a good choice because they are usually frozen immediately after harvest, helping to retain nutrients. Processed foods usually contain fewer essential nutrients, including carotenoids and lutein. Try to choose unprocessed or minimally processed food. Maintaining a healthy lifestyle is not limited to diet. Regular exercise, maintaining good sleep quality and managing stress are also essential to maintain eye health and overall health.

4.4 Case analysis

Mr. Zhang, a 70 year old retired teacher, recently found signs of early macular degeneration in the annual health examination. His visual acuity gradually decreased, especially under low light conditions. Mr. Zhang's diet is mainly traditional Chinese food, preferring rice and white flour, with relatively little vegetable intake.

Intervention measures: the dietitian suggested that Mr. Zhang increase the intake of foods rich in carotenoids and lutein, such as adding a portion of dark green vegetables (such as spinach or cabbage) every day, and including some colored vegetables such as carrots and sweet peppers in each meal. In view of Mr Zhang's age and early macular degeneration, the doctor advised him to start taking eye health supplements containing lutein and zeaxanthin. In addition to dietary adjustment, Mr. Zhang was also suggested to increase outdoor activities to obtain enough sunshine and fresh air, and participate in some mild physical exercises, such as walking and Tai Chi.

Intervention effect: after six months of diet and lifestyle adjustment, Mr. Zhang's vision has improved, especially the night vision and the clarity of reading materials. The progression of macular degeneration appeared to be under control at subsequent ophthalmological examination. Mr. Zhang reported that he felt that his overall health had also improved. This case shows that the adjustment of diet and lifestyle, especially increasing the intake of carotenoids and lutein, can have a significant positive impact on the prevention and management of senile eye diseases, especially macular degeneration. It also emphasizes the importance of comprehensive interventions in maintaining the eye health of older people [5].

5. Conclusion

Based on the above research, carotenoids and lutein play an important role in the maintenance of eye health in older people. They jointly promote the health and function of ocular tissues through a variety of mechanisms, including antioxidation, the precursor effect of vitamin A, and light filtration. From the prevention of macular degeneration to the improvement of vision and light sensitivity, these nutrients have shown positive effects in the prevention and management of senile eye diseases.

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