



Lutein and zeaxanthin in eye and skin health

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Abstract Less than 20 of the hundreds of carotenoids found in nature are found in the human body. These carotenoids are present in the body from the foods or dietary supplements that humans consume. The body does not synthesize them. Among the carotenoids present in the body, only lutein and its coexistent isomer, zeaxanthin, are found in that portion of the eye where light is focused by the lens, namely, the macula lutea. Numerous studies have shown that lutein and zeaxanthin may provide significant protection against the potential damage caused by light striking this portion of the retina. In the eye, lutein and zeaxanthin have been shown to filter high-energy wavelengths of visible light and act as antioxidants to protect against the formation of reactive oxygen species and subsequent free radicals. Human studies have demonstrated that lutein and zeaxanthin are present in the skin, and animal studies have provided evidence of significant efficacy against light-induced skin damage, especially the ultraviolet wavelengths. Little was known about the protective effects of these carotenoids in human skin until recently. This article reviews the scientific literature pertaining to the effects that lutein and zeaxanthin exhibit in the human eye and skin.

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Introduction

Carotenoids are lipophilic pigments that provide many of the colors found in nature as a result of their light-absorption characteristics. This includes the colors found in plants, flowers, and animals. Carotenoids can be grouped into several subclassifications, with the most familiar being the provitamin A carotenoids (those that can be converted to vitamin A in the human body) and the non-provitamin A carotenoids (those that cannot be converted to vitamin A in the human body). Lutein and zeaxanthin belong to the subclass of non-provitamin A carotenoids known as the xanthophylls. Xanthophylls are also different from other carotenoids because they contain oxygenated substituents. Although xanthophylls have significant structural simi-

larities to other carotenoid compounds, such as beta-carotene, they specifically have free hydroxyl groups at each end of the molecule that provide unique biochemical properties (Figure 1).¹ These hydroxyl groups are responsible for the characteristics of lutein and zeaxanthin that allow them to orient within cell membranes and lipoproteins in ways other carotenoids cannot.²⁻⁴

Lutein and zeaxanthin, like other carotenoids, are not produced by the human body and must be consumed in the diet. Lutein and zeaxanthin are present in high concentrations in green leafy vegetables such as spinach and kale.^{5,6} These xanthophylls are also present in egg yolks as a result of poultry feed supplemented with lutein and zeaxanthin. Although eggs do not contain the same levels of lutein and zeaxanthin found in leafy vegetables, recent evidence shows that these xanthophylls from eggs are significantly more bioavailable.⁷ Consumption of these foods results in the presence of lutein and zeaxanthin in human blood serum along with other carotenoids (Table 1).^{8,9} Although the exact

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