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LUTEIN AND ZEAXANTHIN: THE NEXT VITAMINS?

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The human diet is composed of hundreds of different molecules, classified into nutrients (proteins, lipids, carbohydrates) and micronutrients (vitamins, minerals and trace elements). In order to be defined as a vitamin, a molecule should be organic, found in small amounts in the human diet (i.e. we should consume less than 1 g/d), not synthesized by the human body (or in insufficient amount to meet the body requirements), needed to sustain life (by exerting a biological function and/or by preventing a disease). The human diet contains a multitude of molecules that have not been defined as nutrients or micronutrients because their essentiality for human health has not yet been demonstrated, although most of them exert some biological effects. Nutritionists have focused most of their interest on phytochemicals, i.e. chemical compounds that occur naturally in plants, following the publication of numerous studies suggesting their involvement in the beneficial health effects associated with fruit and vegetable consumption. Phytochemicals include several families of molecules such as polyphenols, terpenoids (which includes carotenoids), organosulfur compounds, etc... Among all the phytochemicals, lutein (LUT) and zeaxanthin (ZEA) are the closest to be considered as vitamins. Indeed, these carotenoids meet all the criteria, except that there is no definite evidence of their need to sustain life. Nevertheless, their presence at very high concentration in the human macula, the yellow spot of the retina, and a growing body of evidence from clinical studies, suggest that they have a specific biological function in the eye and that they prevent eye degenerative diseases. Several studies have demonstrated that they increase visual acuity and quench 400-450 nm blue light, which is harmful for photoreceptors. Several other studies, including randomized controlled trials, have also suggested that they diminish the incidence of 2 eye degenerative diseases, namely cataract and age-related macular degeneration (ARMD). However, the required proof for LUT and ZEA to be classified as vitamins would be that their deprivation in the diet of healthy humans leads to a significant impairment of a biological function (eye function being the best candidate) or to the appearance of a disease (cataract or ARMD being the best candidates). Moreover, these effects should be reversed upon re-feeding. Obviously, it is not possible for methodological

and ethical reasons to perform such a study of depletion. Indeed, avoiding LUT- and ZEA-containing foods will inevitably lead to deplete the diet in other chemicals that could also affect biological functions. Nevertheless, accumulating evidence on the role of these xanthophylls in proper eye function and in prevention of ARMD might constitute a sufficient proof for their classification as vitamins in the (near) future.