Dietary Antioxidants, Circulating Antioxidant Concentrations, Total Antioxidant Capacity, and Risk of All-Cause Mortality: A Systematic Review and Dose-Response Meta-Analysis of Prospective Observational Studies

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ABSTRACT

The associations of various dietary or circulating antioxidants with the risk of all-cause mortality in the general population have not been established yet. A systematic search was performed in PubMed and Scopus, from their inception up to October 2017. Prospective observational studies reporting risk estimates of all-cause mortality in relation to dietary intake and/or circulating concentrations of antioxidants were included. Random-effects meta-analyses were conducted. Forty-one prospective observational studies (total n = 507,251) involving 73,965 cases of all-cause mortality were included. The RRs of all-cause mortality for the highest compared with the lowest category of circulating antioxidant concentrations were as follows: total carotenoids, 0.60 (95% CI 0.46, 0.74); vitamin C, 0.61 (95% CI 0.53, 0.69); selenium, 0.62 (95% CI 0.45, 0.79); β-carotene, 0.63 (95% CI 0.57, 0.70); α-carotene, 0.68 (95% CI 0.58, 0.78); total carotenoids, 0.68 (95% CI 0.56, 0.80); lycopene, 0.73 (95% CI 0.54, 0.97); and α-tocopherol, 0.84 (95% CI 0.77, 0.91). The RRs for dietary intakes were: total carotenoids, 0.76 (95% CI 0.66, 0.85); total antioxidant capacity, 0.77 (95% CI 0.73, 0.81); selenium, 0.79 (95% CI 0.73, 0.85); α-carotene, 0.79 (95% CI 0.63, 0.94); β-carotene, 0.82 (95% CI 0.77, 0.85); vitamin C, 0.88 (95% CI 0.83, 0.94); and total carotenoids, 0.85 (95% CI 0.81, 0.97). A nonsignificant inverse association was found for dietary zinc, zeaxanthin, lutein, and vitamin E. The nonlinear dose-response meta-analyses demonstrated a linear inverse association in the analyses of dietary β-carotene and total antioxidant capacity, as well as in the analyses of circulating α-carotene, β-carotene, selenium, vitamin C, and total carotenoids. The association appeared to be U-shaped in the analyses of serum lycopene and dietary vitamin C. The present study indicates that adherence to a diet with high antioxidant properties may reduce the risk of all-cause mortality. Our results confirm current recommendations that promote higher intake of antioxidant-rich foods such as fruit and vegetables. Adv Nutr 2018;9:1–16.

Keywords: antioxidants, ascorbic acid, carotenoids, meta-analysis, mortality, prospective studies

Introduction

Noncommunicable diseases (NCDs) are the leading causes of death in the world (1). It has been estimated that ~68% of all global deaths in 2012 were attributable to NCDs (2). Oxidative stress is defined as an imbalance between the production and detoxification of oxidants (3). It is considered to be one of the most important underlying causes of current major public health concerns including type 2 diabetes (4), cardiovascular disease (CVD) (5), and different types of cancers (6–8), and may possibly contribute to the aging process and its related disorders (9). In addition, it has recently been hypothesized that oxidative stress plays an important role in the development and progression of systemic inflammation (10), which is an important underlying cause of chronic diseases.