

Selenium, ultraviolet radiation and the skin

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Summary

Selenium (Se) is a dietary trace mineral in which there has recently been a surge of interest, in both the popular and the scientific press, because of its demonstrated anti-carcinogenic and anti-inflammatory properties in humans. In this short review, I will explain why Se is an important component of cellular anti-oxidant defences and review its protective effects against UV radiation-induced damage to skin cells. Although little is known about whether selenium can protect human skin from UV-induced damage, clinical studies are underway and the anti-oxidant may offer considerable benefits.

Introduction

In industry, selenium (Se) is used for a wide range of applications including the production of semiconductors, medical imaging equipment, photocopiers and stainless steel. It is best known to dermatologists for its effectiveness against *Pityrosporum ovals*, finding use in anti-dandruff shampoos, because it inhibits proliferation of the yeast.

Discovered in 1817 and named for Selene, the Greek moon goddess, in 1959 it was realized that Se is an essential trace element and a component of what became known to be the glutathione peroxidase (GPX) family of enzymes, which break down peroxides. Research in the late 1960s and throughout the 1970s showed that Se was essential for the optimal function of both cellular and humoral immunity.^{1,2} In 1985 Overvad *et al.* demonstrated that Se could prevent UVB-induced skin tumours in hairless mice;³ this was confirmed in studies by Burke⁴ and Pence.⁵ These authors demonstrated that dietary Se supplementation and also topically applied Se⁴ protected mice from the

development of UV-induced squamous carcinomas. Later, Clark *et al.* discovered that in humans, low plasma Se levels predisposed to skin cancer⁶ and that dietary supplements reduced the risk of lung, colorectal, and prostate cancer.⁷

In 1996, Margaret Rayman highlighted the phenomena of falling dietary Se intake to deficiency levels in many European countries (intake in the UK has fallen to 40% of the recommended daily allowance over the past 15–20 years) and how this may be contributing to the rising incidence of various types of cancer, heart disease and infertility.⁸ This was particularly worrying when taken together, on one hand, with the proven effectiveness of dietary Se supplements in protecting against various cancers in a Se-replete population (intake > 90 µg/day in the USA)⁷ and the inertia of the UK government on the other. The recommended dietary intake (RDI) for Se in the UK is 75 µg/day for adult males and 60 µg/day for adult females.

Se is a metalloid, toxic at levels of intake greater than 2–3 mg/day in humans. It enters the food chain from the soil and different areas of the world have endogenously replete Se intakes (North America) or are deficient (parts of China, New Zealand, Europe and West Africa). The fall in UK intake of Se since the 1970s has been explained as a result of cereals being supplied now from the Se-poor fields of Europe, instead of from North America, as was the case previously. The form of Se (inorganic or organic) in dietary supplements confers distinct biological effects. Absorption and utilization of organic and inorganic Se compounds differ.

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Dedication: This review is dedicated to Professor John A. A. Hunter OBE, who was instrumental in facilitating much of our work on selenium. I wish him a long and happy retirement.

Accepted for publication 15 June 2000