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Review article

The use of high-selenium yeast to raise selenium status: how does it measure up?

Margaret P. Rayman

Centre for Nutrition and Food Safety, School of Biomedical and Molecular Sciences, University of Surrey, Guildford GU2 7XH, UK

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Selenium-enriched yeast (Se-yeast) is a common form of Se used to supplement the dietary intake of this important trace mineral. However, its availability within the European Union is under threat, owing to concerns expressed by the European Community (EC) Scientific Committee on Food that Se-yeast supplements are poorly characterised and could potentially cause the build up of Se in tissues to toxic levels. The present review examines the validity of these concerns. Diagrams of the biosynthesis and metabolism of Se compounds show which species can be expected to occur in Se-yeast preparations. Se-yeast manufacture is described together with quality-control measures applied by reputable manufacturers. The way in which speciation of Se-yeast is achieved is explained and results on amounts of Se species in various commercial products are tabulated. In all cases described, selenomethionine is the largest single species, accounting for 54–74 % of total Se. Se-yeast is capable of increasing the activity of the selenoenzymes and its bioavailability has been found to be higher than that of inorganic Se sources in all but one study. Intervention studies with Se-yeast have shown the benefit of this form in cancer prevention, on the immune response and on HIV infection. Of about one dozen supplementation studies, none has shown evidence of toxicity even up to an intake level of 800 μg Se/d over a period of years. It is concluded that Se-yeast from reputable manufacturers is adequately characterised, of reproducible quality, and that there is no evidence of toxicity even at levels far above the EC tolerable upper intake level of 300 μg/d.

Selenium-enriched yeast: Speciation: Bioavailability: Toxicity

The trace mineral Se is a crucial nutrient for human health. It is a component of a number of important selenoproteins and enzymes required for such functions as antioxidant defence, reduction of inflammation, thyroid hormone production, DNA synthesis, fertility and reproduction (Rayman, 2000). It can also be converted in the body to Se metabolites that are thought to reduce the blood supply to tumours and kill cancer cells (Combs & Lü, 2001). Adequate dietary intakes of Se are therefore essential.

Se enters the food chain through plants and its concentration in foods is determined by a number of geological and geographical factors (Diplock, 1993; Fordyce *et al.* 2000; Johnson *et al.* 2000; Adams *et al.* 2002). These are: (i) soil Se species and concentration; (ii) pH, which determines to some extent the nature of the Se species; (iii) amounts of organic matter, iron hydroxides, Al compounds and clay that can bind Se, reducing its bioavailability to plants; (iv) amounts of S species (for example, from S fertilisers) that can compete with Se for absorption; (v) rainfall that can leech Se out of the soil; (vi) soil microbes that can convert insoluble forms of Se to soluble forms. In some parts of the world where Se is insufficiently available to plants, Se-deficiency diseases have been identified, such as Keshan disease, an endemic cardiomyopathy found in the North East of China (Keshan Disease Research Group, 1979) that formerly caused many deaths. Supplementation with Se has greatly reduced the incidence of the condition (Reilly, 1996).

There are other regions of the world, such as the south island of New Zealand and parts of China and Europe, where Se intake may not be adequate for full activity of protective selenoenzymes. Governments have set dietary reference values for Se intake based on their assessment of the amount of Se required to achieve optimal (or two-thirds optimal) activity of the antioxidant selenoenzyme glutathione peroxidase in plasma (Committee on Medical Aspects of Food Policy, 1991; World Health Organization/Food and Agriculture Organization/International

Abbreviations: EU, European Union; HCC, hepatocellular carcinoma; NPC, Nutritional Prevention of Cancer; PRECISE, Prevention of Cancer by Intervention with Selenium; SeMet, L-selenomethionine; SeCys, selenocysteine; Se-yeast, Selenium-enriched yeast.

* **Corresponding author:** Dr M. P. Rayman, fax +44 1483 300374, email M.Rayman@surrey.ac.uk