

# Selenium, selenoproteins and human health: a review

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## Abstract

Selenium is of fundamental importance to human health. It is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defence systems, and immune function. The decline in blood selenium concentration in the UK and other European Union countries has therefore several potential public health implications, particularly in relation to the chronic disease prevalence of the Western world such as cancer and cardiovascular disease. Ten years have elapsed since recommended dietary intakes of selenium were introduced on the basis of blood glutathione peroxidase activity. Since then 30 new selenoproteins have been identified, of which 15 have been purified to allow characterisation of their biological function. The long term health implications in relation to declining selenium intakes have not yet been thoroughly examined, yet the implicit importance of selenium to human health is recognised universally.

Selenium is incorporated as selenocysteine at the active site of a wide range of selenoproteins. The four glutathione peroxidase enzymes (classical GPx1, gastrointestinal GPx2, plasma GPx3, phospholipid hydroperoxide GPx4) which represent a major class of functionally important selenoproteins, were the first to be characterised.

Thioredoxin reductase (TR) is a recently identified seleno-cysteine containing enzyme which catalyzes the NADPH dependent reduction of thioredoxin and therefore plays a regulatory role in its metabolic activity.

Approximately 60% of Se in plasma is incorporated in selenoprotein P which contains 10 Se atoms per molecule as selenocysteine, and may serve as a transport protein for Se. However, selenoprotein-P is also expressed in many tissues which suggests that although it may facilitate whole body Se distribution, this may not be its sole function.

A second major class of selenoproteins are the iodothyronine deiodinase enzymes which catalyse the 5'<sup>5</sup>-mono-deiodination of the prohormone thyroxine (T<sub>4</sub>) to the active thyroid hormone 3,3'<sup>5</sup>-triiodothyronine (T<sub>3</sub>).

Sperm capsule selenoprotein is localised in the mid-piece portion of spermatozoa where it stabilises the integrity of the sperm flagella.

Se intake effects tissue concentrations of selenoprotein W which is reported to be necessary for muscle metabolism.

It is of great concern that the health implications of the decline in Se status in the UK over the past two decades have not been systematically investigated. It is well recognised that dietary selenium is important for a healthy immune response. There is also evidence that Se has a protective effect against some forms of cancer; that it may enhance male fertility; decrease cardiovascular disease mortality, and regulate the inflammatory mediators in asthma. The potential influence of Se on these chronic diseases within the European population are important considerations when assessing Se requirement.

**Keywords**  
Selenium  
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