

Review Article

Food-chain selenium and human health: emphasis on intake

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Following the publication of the landmark trial of Clark *et al.* in 1996 that appeared to show that Se could reduce the risk of cancer, awareness of the importance of Se to human health has markedly increased. As a result, there is now much more aggressive marketing of Se supplements and functional foods, even in situations where additional consumption of Se is inappropriate. The present review addresses how Se gets into the food chain, the wide variability in Se content of foods and the very different levels of intake between countries and regions. Though it is clear that there are adverse consequences for health of both deficient and excessive intake, health effects at intermediate levels of intake are less certain. Thus it is difficult to define optimal intake which depends on a large number of factors, such as which functions of Se are most relevant to a particular disease state, which species of Se is most prominent in the Se source, which health condition is being considered, the adequacy or otherwise of intake of other nutrients, the presence of additional stressors, and lastly whether the ability to make selenoproteins may be compromised. These complexities need to be understood, particularly by policy makers, in order to make informed judgments. Potential solutions for increasing Se intake, where required, include agronomic biofortification and genetic biofortification or, for individuals, increased intake of naturally Se-rich foods, functional foods or supplements. The difficulties of balancing the risks and benefits in relation to Se intake are highlighted.

Selenium: Intake: Selenium in foods: Selenium and human health: Optimal intake

There is a much greater awareness now of the importance of Se to human health than there was even 10 years ago. This is partly due to the publication of the landmark trial of Clark *et al.*⁽¹⁾ that appeared to show that Se could reduce the risk of cancer. As a result, there is now much more aggressive marketing of Se supplements and functional foods, even in situations where additional consumption of Se is inappropriate.

Both individuals, who take a measure of responsibility for their own health and that of their families, and more importantly, advisory bodies, need to be aware of the complexities surrounding the issue of optimal Se intake in order to make informed judgments. The subject is often treated too simplistically. The present review attempts to air the issues that need to be considered.

Perhaps primarily, individuals need to be aware of the baseline intake in their country or region and whether that intake is adequate or not. There are currently too few data on which to base this judgment, hence companies are able to market Se supplements or functional foods to populations that may already have a perfectly adequate intake of Se. Even in relatively low Se areas, some individuals may consume foods of good Se content (for example, fish) or containing more potent Se species (for example, from garlic, onions or broccoli)

that may give them a higher or more effective intake than might be predicted. An appropriate intake for an individual who is a cigarette smoker or has a family history of prostate cancer may well not be the same as for an individual with a family history of squamous cell carcinoma or diabetes. Individuals may eventually learn whether they have a compromised ability to make selenoproteins, in which case they may need to increase their intake of Se-rich foods.

On the other hand, some evidence is now emerging that links the risk of more subtle adverse health effects to levels of intake well below those known to be toxic. There may even be a possibility of increased risk of one condition even where risk of another is reduced.

An understanding of these niceties requires a certain background knowledge such as: how Se gets into the food chain; the variability of Se content of foods and how that content is affected by food preparation or cooking; how intake varies according to country or region of country; health effects in relation to level of intake and the factors modifying those effects. These issues are addressed below, following which the potential solutions for increasing Se intake, if required, are discussed. Lastly, the difficulties of balancing the risks and benefits in relation to Se intake are highlighted.

Abbreviations: GPx, glutathione peroxidase; NPC, Nutritional Prevention of Cancer; RNI, reference nutrient intake.

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