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Selenium in humans: which is the safe range of intake?

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The role of selenium in human health and disease has been object of extreme interest in the latest years, as shown by the large and still quickly growing number of studies which investigated the biological properties and health effects of this essential trace element. Laboratory and epidemiologic studies support a broad and sometimes very conflicting pattern of effects, making it difficult to reconcile such evidence in single unifying view. In fact, among other properties selenium has been suggested to both protect against cancer and to induce it, to protect against diabetes and to exert diabetogenic effects, to be neurotoxic and neuroprotective, and under a toxicological perspective to be both pro-oxidant and anti-oxidant, genotoxic and anti-genotoxic. Adding further complexity to this issue, a few randomized trials have been carried out using organic selenium in US populations, yielding results considerably changing over time and showing concerning findings in the most recent studies.

In addition, throughout the latest decades there have been considerably uncertainty and debate about the best criteria to assess adequacy of selenium exposure, in order to avoid both deficiency and overexposure. Under this perspective, both proteomic markers and epidemiological considerations have been proposed to identify a safe range of intake of the metalloid, but the evaluations of regulatory agencies as well as of investigators greatly differ about which indicators are to be chosen and to what extent may be reliable.

A final issue which must be considered when assessing the human health effects of selenium are the specific selenium compounds under consideration, its speciation. The various chemical forms of this element have shown markedly different effects in laboratory and veterinary studies, and this may considerably influence its health effects in the human. The selenium species found in drinking water and in the occupational environment, for example, are exclusively or mainly inorganic, while selenium compounds in foods mainly tend to be organic, thus showing markedly different metabolism and pronounced differences in nutritional and toxic properties.

In this presentation, the epidemiologic evidence underlying the issue of selenium safe range of intake, as well as the potential nutritional and toxicological endpoints to be considered in such risk assessment, will be summarized, critically analyzed and discussed.