

Abstract

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Dietary reference values of individual micronutrients and nutriomes for genome damage prevention: current status and a road map to the future.

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BACKGROUND: Damage to the genome is recognized as a fundamental cause of developmental and degenerative diseases. Several micronutrients play an important role in protecting against DNA damage events generated through endogenous and exogenous factors by acting as cofactors or substrates for enzymes that detoxify genotoxins as well as enzymes involved in DNA repair, methylation, and synthesis. In addition, it is evident that either micronutrient deficiency or micronutrient excess can modify genome stability and that these effects may also depend on nutrient-nutrient and nutrient-gene interaction, which is affected by genotype.

DISCUSSION AND SUMMARY: These observations have led to the emerging science of genome health nutrigenomics, which is based on the principle that DNA damage is a fundamental cause of disease that can be diagnosed and nutritionally prevented on an individual, genetic subgroup, or population basis. In this article, the following topics are discussed: 1) biomarkers used to study genome damage in humans and their validation, 2) evidence for the association of genome damage with developmental and degenerative disease, 3) current knowledge of micronutrients required for the maintenance of genome stability in humans, 4) the effect of nutrient-nutrient and nutrient-genotype interaction on DNA damage, and 5) strategies to determine dietary reference values of single micronutrients and micronutrient combinations (nutriomes) on the basis of DNA damage prevention.

CONCLUSIONS: This article also identifies important knowledge gaps and future research directions required to shed light on these issues. The ultimate goal is to match the nutriome to the genome to optimize genome maintenance and to prevent pathologic amounts of DNA damage.

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