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Scientists discover how vitamins and minerals may prevent age-related diseases

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Severe deficiency of the vitamins and minerals required for life is relatively uncommon in developed nations, but modest deficiency is very common and often not taken seriously. A new research published online in the *FASEB Journal*, however, may change this thinking as it examines moderate selenium and vitamin K deficiency to show how damage accumulates over time as a result of vitamin and mineral loss, leading to age-related diseases.

"Understanding how best to define and measure optimum nutrition will make the application of new technologies to allow each person to optimize their own nutrition a much more realistic possibility than it is today." said Joyce C. McCann, Ph.D., a co-author of the study from the Nutrition and Metabolism Center at Children's Hospital Oakland Research Institute in Oakland, California. "If the principles of the theory, as demonstrated for vitamin K and selenium, can be generalized to other vitamins and minerals, this may provide the foundation needed."

McCann and colleagues reached their conclusions by compiling and assessing several general types of scientific evidence. They tested whether selenium-dependent proteins that are essential from an evolutionary perspective are more resistant to selenium deficiency than those that are less essential. They discovered a highly sophisticated array of mechanisms at cellular and tissue levels that, when selenium is limited, protect essential selenium-dependent proteins at the expense of those that are nonessential. They also found that mutations in selenium-dependent proteins that are lost on modest selenium deficiency result in

characteristics shared by age-related diseases including cancer, heart disease, and loss of immune or brain function. Results should inform attempts to locate mechanistic linkages between vitamin or mineral deficiencies and age-related diseases by focusing attention on the vitamin and mineral-dependent proteins that are nonessential from an evolutionary perspective. Such mechanistic linkages are likely to present opportunities for treatment.

"This paper should settle any debate about the importance of taking a good, complete, multivitamin every day," said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal. "As this report shows, taking a multivitamin that contains selenium is a good way to prevent deficiencies that, over time, can cause harm in ways that we are just beginning to understand."

More information: Joyce C. McCann and Bruce N. Ames. Adaptive dysfunction of selenoproteins from the perspective of the triage theory: why modest selenium deficiency may increase risk of diseases of aging . FASEB J. 2011 25:1793-1814. doi: 10.1096/fj.11-180885

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