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Antioxidative effects of molybdenum and its association with reduced prevalence of hyperuricemia: a cross-sectional analysis of the United States adult population

Jeonghwan Lee[1], Joo Hong Joun[2], Jung Pyo Lee[2], Yun Kyu Oh[2], Chun Soo Lim[2]
[1]Department of Internal Medicine-Nephrology, SMG-SNU Boramae Medical Center, Korea, Republic of
[2]Department of Internal Medicine-Nephrology, Seoul National University College of Medicine, Korea, Republic of

Objectives: Molybdenum is an essential trace metal that can mitigate oxidative stress, one of the etiological explanations for kidney disease and its comorbidities including gout. However, the relationship between molybdenum and kidney-related disease outcomes, including hyperuricemia, is under-investigated both experimentally and in population-side studies. This study aims to determine, epidemiologically and experimentally, whether molybdenum and its antioxidative property are associated with the prevalence of hyperuricemia.

Methods: Urinary molybdenum's epidemiological relationship to hyperuricemia and kidney-disease related parameters/outcomes was evaluated in 15370 adult participants in the National Health and Nutrition Examination Survey (NHANES) collected between 1999 and 2016. Individuals' urinary molybdenum levels were measured and corrected to their respective urinary creatinine concentrations to yield urinary molybdenum-to-creatinine ratios. The association between urinary molybdenum-to-creatinine ratio and various kidney-disease related parameters/outcomes were assessed by multivariable linear and logistic regression analyses, adjusting for covariates including age, sex, ethnicity, diabetes mellitus, hypertension, body mass index, and serum uric acid. Regression analyses were also performed for other control elements comparable to molybdenum.

Results: In the adult NHANES population, urinary molybdenum-to-creatinine ratio was significantly associated with decreased serum uric acid (β, -0.119; 95% CI, -0.148-0.090; $P < 0.001$) concentrations, and decreased prevalence of hyperuricemia (OR, 0.729; 95% CI, 0.639-0.830; $P < 0.001$) and gout (OR, 0.708; 95% CI, 0.519-0.965; $P = 0.03$). In HK-2 cells under H_2O_2-induced oxidative stress, molybdenum upregulated manganese superoxide dismutase expression and decreased oxidative stress.

Conclusions: These findings suggest that urinary molybdenum levels are associated with decreased prevalence of hyperuricemia and gout in adults. Molybdenum demonstrated antioxidative properties in kidney proximal tubular epithelial cells.