

Ambient Cadmium Importantly Up-Regulates Systemic Oxidative Stress

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There are several studies showing that urinary cadmium levels (thought to provide the best assessment of Cd body burden) correlate tightly with urinary levels of oxidatively damaged DNA bases (8-hydroxy-2-deoxyguanosine or 8-oxodG); 4 studies compare these base levels above and below the median Cd concentration.¹⁻⁴ In the upper half of the urinary Cd distribution, as compared to the lower half, the level of oxidized bases was 28%, 32%, 36%, 38%, 39%, 48%, and 69% higher (avg 41%). None of these studies involved workers exposed to exceptional levels of Cd.

In other words, ambient variations of Cd body stores are a huge determinant of systemic oxidative stress - and associated oxidative damage to DNA. This might explain why Cd is linked not only to cancer,⁵⁻⁷ but vascular disease,⁸⁻¹⁴ liver disease,¹⁵ and other disorders.

The source of this increased oxidative stress is not yet clear. There are several studies showing that, in specific tissues or cells, Cd exposure boosts NADPH oxidase activity.¹⁶⁻¹⁹ Diminished expression of certain antioxidant enzymes may also contribute to this effect.²⁰

So far, only one study has examined the impact of spirulina feeding on Cd toxicity. This evaluates the teratogenic impact of Cd injection in pregnant mice.²¹ Spirulina dose-dependently inhibited the teratogenicity, almost completely eliminating it at 500 g/kg/d. Notably, this dose also completely reversed the impact of Cd on markers of oxidative stress in the fetuses. This suggests that Cd-mediated oxidative stress is produced largely by NADPH oxidase activation, and that spirulina can prevent this effect.

Three recent studies have found that urinary Cd correlates directly with breast cancer risk.^{22, 23} These suggest that Cd exposure is responsible for 40-65% of the cancer. (The higher figure was in Japan, where other inducers of breast cancer may be less prominent than in the West.) Another recent study found that breast cancer risk was reduced by about 50% in women who had taken zinc supplements for at least 10 years.²⁴ A recent study from southern Louisiana, where soil Cd levels tend to be high, suggests that Cd exposure may be responsible for 73% of pancreatic cancer.²⁵ There is also a recent report that the ratio of estimated dietary zinc intake to urinary Cd correlates inversely with global cancer mortality in both men and women.²⁶ And in an ecologic analysis of cancer rates in the U.S., regional zinc intakes determined in the NHANES-III study were found to vary inversely with risks for 12 types of cancer; this paper also cites 8 previous observational studies in which increased dietary zinc intakes correlated significantly with decreased risk for various cancers.²⁷

Zinc, magnesium, and spirulina supplementation - and avoidance of iron deficiency - may be the antidote to Cd exposure.²⁸

References

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