

# **Association of blood arsenic levels with increased reactive oxidants and decreased antioxidant capacity in a human population of northeastern Taiwan**

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## **Abstract**

Arsenic is a notorious environmental toxicant known as both a carcinogen and an atherogen in human beings, but the pathogenic mechanisms are not completely understood. In cell culture studies, trivalent arsenic enhanced oxidative stress in a variety of mammalian cells, and this association may be closely associated with the development of arsenic-related diseases. To investigate the effect of arsenic exposure on oxidative stress in humans, we conducted a population study to determine the relationships of blood arsenic to reactive oxidants and antioxidant capacity at the individual level. We recruited 64 study subjects ages 42-75 years from residents of the Lanyang Basin on the northeast coast of Taiwan, where arsenic content in well water varies from 0 to  $\geq 3,000$  microg/L. We used a chemiluminescence method, with lucigenin as an amplifier for measuring superoxide, to measure the plasma level of reactive oxidants. We used the azino-diethyl-benzthiazoline sulphate method to determine the antioxidant capacity level in plasma of each study subject. We determined arsenic concentration in whole blood by hydride formation with an atomic absorption spectrophotometer. The average arsenic concentration in whole blood of study subjects was  $9.60 \pm 9.96$  microg/L ( $\pm$  SD) with a range from 0 to 46.50 microg/L. The level of arsenic concentration in whole blood of study subjects showed a positive association with the level of reactive oxidants in plasma ( $r = +0.41$ ,  $p = 0.001$ ) and an inverse relationship with the level of plasma antioxidant capacity ( $r = -0.30$ ,  $p = 0.014$ ). However, we found no significant association ( $p = 0.266$ ) between levels of plasma reactive oxidants and antioxidant capacity. Our results also show that the lower the primary arsenic methylation capability, the lower the level of plasma antioxidant capacity ( $p = 0.029$ ). These results suggest that ingestion of arsenic-contaminated well water may cause deleterious effects by increasing the level of reactive oxidants and decreasing the level of antioxidant capacity in plasma of individuals. Persistent oxidative stress in peripheral blood may be a mechanism underlying the carcinogenesis and atherosclerosis induced by long-term arsenic exposure.