

News Release

Emerging hazard: exposure to fish-derived arsenobetaine increases a latent risk of hypertension in humans and mice

Key Points

- Urinary arsenobetaine (AsB) but not the other arsenic species was associated with hypertension (HT).
- Higher fish intake was associated with AsB-mediated HT in the mediation analysis.
- Exposure to an estimated human-equivalent AsB dose increased mouse blood pressure.
- AsB exposure, which is associated with fish consumption, may increase the risk of HT.
- With rising global fish intake, AsB may be an emerging cardiovascular risk factor.

Summary

Dr. Takumi Kagawa and Prof. Masashi Kato at Department of Occupational and Environmental Health, Nagoya University Graduate School of Medicine found that arsenobetaine, an arsenic species abundant in seafood, may be associated with hypertension. Analysis of 2,676 Japanese residents showed an association between urinary AsB levels and hypertension, which was further supported by a mouse study. These findings suggest a previously unrecognized link between fish-derived AsB exposure and hypertension.

Research Background

A previous epidemiological study showed that higher total serum arsenic levels were associated with an increased risk of hypertension. However, the specific arsenic species contributing to arsenic-induced hypertension remains unknown. Speciation analysis of arsenic in serum samples is technically challenging. Therefore, this cross-sectional study investigated the associations between fasting urinary levels of total arsenic and four speciated arsenic species and the prevalence of hypertension among 2,676 Japanese residents, one of the world's leading fish-consuming populations. A follow-up animal study was conducted to corroborate these epidemiological findings.

Research Results

Consistent with the serum findings, total urinary arsenic levels were positively

associated with the prevalence of hypertension. Unlike dimethylarsinate, monomethylarsinate, and inorganic arsenic, arsenobetaine, an organic arsenic species considered non-toxic, was consistently associated with the prevalence of hypertension independent of sodium exposure in both univariate and multivariate models. This association remained robust in a Bayesian kernel machine regression model accounting for combined exposure to the four arsenic species. Causal mediation analysis further suggested that higher fish meat consumption may promote arsenobetaine-mediated hypertension and that increased urinary arsenobetaine is associated with hypertension-mediated cardiovascular diseases. Correspondingly, a 4-week oral exposure to an estimated human-equivalent dose of arsenobetaine, but not dimethylarsinate, increased blood pressure in mice.

Research Summary and Future Perspective

This human and animal study is the first to suggest that increased exposure to arsenobetaine, which is linked to fish meat consumption, increases the risk of hypertension. Given the global increase in fish consumption, arsenobetaine ingestion may be an emerging international cardiovascular health concern.

Publication

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