

Higher selenium and manganese levels during pregnancy may protect babies from future high blood pressure

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Children who were exposed to higher levels of trace minerals manganese and selenium during their mothers' pregnancy had a lower risk of high

blood pressure in childhood, according to a study led by researchers at the Johns Hopkins Bloomberg School of Public Health.

The researchers analyzed the levels of toxic metals and trace minerals in [blood samples](#) drawn from nearly 1,200 women in the Boston area who gave birth between 2002 and 2013. They found that higher levels of selenium or manganese in the mothers' blood were associated with lower [blood pressure](#) readings in their children at clinic visits 3 to 15 years later.

The researchers also observed that manganese had a stronger inverse relationship with childhood blood [pressure](#) when maternal blood levels of [cadmium](#), a [toxic heavy metal](#), were higher—hinting that manganese lowers blood pressure in part by countering a blood pressure-raising effect of cadmium.

The results appear online June 23 in *Environmental Health Perspectives*.

"These results suggest that healthy levels of selenium and manganese in mothers' diets during pregnancy may protect their children against developing high blood pressure," says study senior author Noel Mueller, Ph.D., assistant professor in the Bloomberg School's Department of Epidemiology. "This work highlights the importance of nutrition and environmental exposures in the womb for a child's cardiovascular health and, as we continue research this further, could eventually lead to updated nutritional guidance and environmental regulations aimed at preventing disease."

Hypertension is one of the major modifiable risk factors for other debilitating and deadly diseases including heart disease, stroke, kidney failure, and Alzheimer's disease. It is also very common; the U.S. Centers for Disease Control and Prevention estimates that about half of Americans over the age of 20 have hypertension—defined as [systolic](#)

[blood pressure](#) above 130 mm Hg or diastolic blood pressure above 80 mm Hg—or have been prescribed antihypertensive drugs.

Prior research suggests that the predisposition to hypertension can start early in life, even in the womb, and that protection from that predisposition also can start early. The researchers examined these questions in the study: They compared children's blood pressure readings to levels of toxic metals and trace minerals in their mothers' blood; they measured the toxic metals lead, mercury, and cadmium, which have been linked to hypertension in adults; and they looked at levels of the trace minerals manganese and selenium, which have been linked to lower blood pressure.

The dataset used for the analysis covered 1,194 mother-child pairs from a study known as the Boston Birth Cohort. Blood pressure readings in the children were taken at ages ranging from 3-15 years. Most of the mothers were Black (61 percent) or Hispanic (20 percent).

Although a preponderance of earlier evidence linked lead, mercury, and cadmium to [high blood pressure](#) and heart diseases in adults, the researchers did not find a link between these toxic metals with childhood blood pressure in this study. They did, however, observe a link between the mothers' levels of selenium and lower blood pressure in their offspring during childhood. For every doubling of maternal selenium levels, children's systolic blood pressure was found on average to be 6.23 points lower. Manganese showed a similar albeit weaker relationship to blood pressure: A doubling of exposure was associated with 2.62 points lower systolic blood pressure on average.

Although cadmium on its own was not linked to childhood blood pressure, the researchers found that when maternal blood levels of cadmium were higher, the inverse relationship between manganese and childhood blood pressure was significantly stronger. That finding hints

that manganese can specifically protect against the hypertension-promoting effect of cadmium, and may even mask cadmium's hypertension-promoting effect in normal populations.

"People often assume that exposures to heavy metals such as cadmium occur only in occupational settings, but in fact these metals are all around us—for example, cadmium is found in ordinary cigarette smoke," says study first author Mingyu Zhang, a Ph.D. candidate in Mueller's research group.

Underscoring the apparent cadmium link, the researchers observed that [manganese](#) was associated much more strongly with lower [blood](#) pressure in children whose mothers had smoked during pregnancy.

Manganese and selenium have antioxidant properties and are found in a variety of foods including nuts and grains, leafy vegetables, fish and shellfish.

The researchers will aim to replicate their findings in studies based on other birth cohorts. Johns Hopkins maintains a registry of birth cohort datasets under its Environmental influences on Child Health Outcomes (ECHO) Program.

More information: Mingyu Zhang et al, In Utero Exposure to Heavy Metals and Trace Elements and Childhood Blood Pressure in a U.S. Urban, Low-Income, Minority Birth Cohort, *Environmental Health Perspectives* (2021). [DOI: 10.1289/EHP8325](https://doi.org/10.1289/EHP8325)

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