Fatty acids in fish may shield brain from mercury damage

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A school of sardines in Italy. Credit: Wikimedia / Alessandro Duci

New findings from research in the Seychelles provide further evidence that the benefits of fish consumption on prenatal development may offset the risks associated with mercury exposure. In fact, the new study, which appears today in the *American Journal of Clinical Nutrition*, suggests that the nutrients found in fish have properties that protect the

brain from the potential toxic effects of the chemical.

Three decades of research in the Seychelles have consistently shown that high levels of fish consumption by pregnant mothers - an average of 12 meals per week - do not produce developmental problems in their children. Researchers have previously equated this phenomenon to a kind of biological horse race, with the developmental benefits of nutrients in fish outpacing the possible harmful effects of mercury also found in fish. However, the new research indicates that this relation is far more complex and that compounds present in fish - specifically polyunsaturated fatty acids (PUFA) - may also actively counteract the damage that mercury causes in the brain.

"These findings show no overall association between prenatal exposure to mercury through fish consumption and neurodevelopmental outcomes," said Edwin van Wijngaarden, Ph.D., and associate professor in the University of Rochester Department of Public Health Sciences and a co-author of the study. "It is also becoming increasingly clear that the benefits of fish consumption may outweigh, or even mask, any potentially adverse effects of mercury."

"This research provided us the opportunity to study the role of polyunsaturated fatty acids on development and their potential to augment or counteract the toxic properties of mercury," said Sean Strain, Ph.D., a professor of Human Nutrition at the Ulster University in Northern Ireland and lead author of the study. "The findings indicate that the type of fatty acids a mother consumes during pregnancy may make a difference in terms of their child's future neurological development."

The new study comes as the U.S. Food and Drug Administration and international agencies are in the process of revisiting fish consumption advisories to better reflect the health benefits of nutrients found in fish.

The FDA's current guidance - which recommends that pregnant women limit their consumption of certain fish to twice a week - was established because of the known risk of high level mercury exposure on childhood development.

Mercury is found in the environment as a result of both natural and human (e.g. coal plant emissions) activity. Much of it ends up being deposited in the world's oceans and, as a result, fish harbor the chemical in very small amounts.

This has given rise to concerns that the cumulative impact of prenatal exposure to mercury through fish consumption may have negative health outcomes, despite the fact that that a link between low-level exposure and developmental consequences in children has never been definitively established.

At the same time, fish are rich in a host of beneficial nutrients, including fatty acids, which are essential to brain development, leading to a long-standing exchange among scientists, environmentalists, and policymakers over the risk vs. benefit of fish consumption. This debate has significant consequences for global health, as billions of people across the world rely on fish as their primary source of protein.

The Seychelles Child Development Study - a partnership between the University of Rochester Ulster University, and the Republic of Seychelles Ministry of Health and Education - is one of the longest and largest population studies of its kind. The Seychelles, a cluster of islands in the Indian Ocean, has proven to be the ideal location to examine the potential health impact of persistent low-level mercury exposure. The nation's 89,000 residents consume fish at a rate 10 times greater than the populations of the U.S. and Europe.

The study published today followed more than 1,500 mothers and their

children. At 20 months after birth, the children underwent a battery of tests designed to measure their communication skills, behavior, and motor skills. The researchers also collected hair samples from the mothers at the time of their pregnancy to measure the levels of prenatal mercury exposure.

The researchers found that mercury exposure did not correlate with lower test scores. This finding tracked with the results of previous studies by the group - some of which have followed children in the Seychelles into their 20s - that have also shown no association between fish consumption and subsequent neurological development.

The researchers also measured the PUFA levels present in the pregnant women and found that the children of mothers with higher levels of fatty acids known as n3 - the kind found in fish - performed better on certain tests. Another common form of PUFA, called n6, comes from other meats and cooking oils and is found in greater abundance in the diets of residents of developed countries.

The fatty acids in fish (n3) are known to have anti-inflammatory properties, compared to n6, which can promote inflammation. One of the mechanisms by which mercury inflicts its damage is through oxidation and inflammation and this has led the researchers to speculate that not only does n3 provide more benefit in terms of brain development, but that these compounds may also counteract the negative effects of mercury.

This was reflected in the study's findings, which showed that the children of mothers with relatively higher levels of n6 did poorer on tests designed to measure motor skills.

"It appears that relationship between fish nutrients and mercury may be far more complex than previously appreciated," said Philip Davidson,

Ph.D., the principal investigator of the Seychelles Child Development Study, a professor emeritus at the University of Rochester, and senior author of the study. "These findings indicate that there may be an optimal balance between the different inflammatory properties of fatty acids that promote fetal development and that these mechanisms warrant further study."

Provided by University of Rochester Medical Center