January Article of the Month

Combined Prenatal Pesticide Exposure and Folic Acid Intake in Relation to Autism

Authors: Rebecca J. Schmidt, Vladimir Kogan, Janie F. Shelton, Lora Delwiche, Robin L. Hansen, Sally Ozonoff, Claudia C. Ma, Erin C. McCanlies, Deborah H. Bennett, Irva Hertz-Picciotto, Daniel J. Tancredi, and Heather E. Volk

ABSTRACT

Background:

In the U.S about 4.4 billion pesticide applications are applied each year in and around homes, resulting in about 80 percent of people's exposure occurring indoors [1]. Children and women of childbearing age who are planning to become pregnant are particularly vulnerable to harm from exposure. Previous studies have linked pesticides, particularly agricultural pesticides, with development of autism spectrum disorder (ASD) in children. The Centers for Disease Control and Prevention (CDC) estimates that 1 in 68 children in the U.S. have an ASD. For boys specifically, the estimate is 1 in 42 with an ASD[2].

Previous studies have shown that folic acid (FA) supplementation protects against neural tube defects like spina bifida, and some studies have shown a reduced risk for ASD in children whose mothers took supplements containing FA[3]. The CDC and the U.S. Preventive Service Taskforce already recommends that all women of childbearing age consume at least 400 mcg of FA daily[4]. However, few studies have examined how FA intake among women experiencing environmental exposures, particularly to pesticides, may be especially beneficial for reducing ASD risk in their offspring.

Objective:

To examine whether maternal intake of FA influences the association between pesticide exposure and ASD in children.

Methods:

Children born in California between 2000-2007, who were enrolled in the Childhood Autism Risks from Genetics and the Environment (CHARGE) study and were either clinically confirmed to have ASD (394) or not (282), participated in this study at 2-5 years old. Information on maternal household pesticide exposure (self-applied sprays, flea products, etc.) and FA intake 3 months before conception and during the entire pregnancy were obtained through interviews. FA intake was measured as high (> 800 mcg), median (800 mcg) and low (<800 mcg). Daily exposure profiles to commercial agriculture pesticides like organophosphates and organochlorines, for the same time period, were generated using California's extensive database and reports on pesticide use, known as PUR data. Information on work-related exposure to pesticides were also obtained but few mothers experienced work exposures during the analysis time period (3 months pre-conception and entire pregnancy).

Results:

Compared to the mothers of non-ASD children, mothers of children with ASD were less likely to report taking >800 mcg of FA during their first month of pregnancy and more likely to be exposed to household pesticides both indoors and outdoors.
The odds of offspring developing ASD were greater among mothers who had both low FA intake and indoor pesticide or any agricultural exposure compared with mothers who had either low FA intake or pesticide exposure.

Conclusion:

Overall, this study shows that the likelihood of ASD associated with pesticides in children was reduced among mothers who had high FA intake (>800 mcg) near the time of conception. Therefore, increasing FA intake among mothers exposed to pesticides may provide protection from adverse neurodevelopment outcomes like ASD.

POLICY IMPLICATIONS

All pesticides sold or distributed in the U.S. are required to be registered and regulated by the U.S. Environmental Protection Agency (EPA). According to an analysis done by the Northwest Coalition for Alternatives to Pesticides and the National Center for Healthy Homes, of the 28 most widely used agricultural pesticides, 18 are associated with reproductive issues[1]. There is increasing evidence that certain pesticides play a crucial role in negatively affecting neurodevelopment and some may even contribute to the development of ASD. A 2014 CHARGE Study found that mothers exposed to organophosphates, including chlorpyrifos, during pregnancy experienced a 60% increased risk for ASD.

Indeed, chlorpyrifos in particular has been studied extensively, and sufficient evidence indicates that there are no safe uses for the pesticide. This was confirmed in EPA's November 2016 revised human health risk assessment of chlorpyrifos. By the time this risk assessment was released, EPA had already begun working towards a ban on the production and use of the pesticide, establishing a final decision deadline of March 30, 2017. Unfortunately the agency reversed their course, deciding against a ban, on March 29, claiming scientific uncertainty.

EPA's work on the revised human health risk assessment is commendable. The extensive scientific evidence of harm the agency has compiled on chlorpyrifos is sufficient to issue a ban. The agency needs to heed their own scientific findings and protect young children and future generations from neurodevelopmental harm.

More research is needed to further investigate the association of prenatal nutrient intake and associations with pesticide exposure and risk for ASD. In addition to informing issues related to pesticide policies and regulations, further research may inform decisions on whether or not federal public health recommendation on FA intake should be adjusted for women of child bearing age. While FA intake was not found to entirely eliminate the risk for ASD in this study, it did reduce the risk, suggesting that increasing FA intake in women, especially those exposed to pesticides, may reduce ASD incidence among their offspring.

REFERENCES

[1] Pesticides. Retrieved December 18, 2017, from http://www.nchh.org/What-We-Do/Health-Hazards--Prevention--and-Solutions/Pesticides.aspx

[2] Autism Spectrum Disorder (ASD). Updated 2016, July 11. Retrieved December 18, 2017, from https://www.cdc.gov/ncbddd/autism/data.html

[3] Brief report: are autistic-behaviors in children related to prenatal vitamin use and maternal whole blood folate concentrations? *US National Library of Medicine National Institutes of Health,* October 2014. Retrieved December 18, 2017, from https://www.ncbi.nlm.nih.gov/pubmed/24710813

[4] Folic Acid. Updated 2016, December 28. Retrieved December 18, 2017, from https://www.cdc.gov/ncbddd/folicacid/recommendations.html

Article found in Environmental Health Perspectives.