

Characterization of white matter microstructure in fetal alcohol spectrum disorders

By Fryer SL, Schweinsburg BC, Bjorkquist OA, Frank LR, Mattson SN, Spadoni AD, Riley EP.. Alcohol Clin Exp Res. 2009 Mar;33(3):514-21.

Despite increased public awareness that drinking during pregnancy can cause permanent harm to the developing child, fetal alcohol spectrum disorders (FASDs) remain a leading cause of preventable disability. Prenatal alcohol exposure can lead to various birth defects including facial malformations and physical growth problems. However, it is typically alcohol's effects on fetal brain development that pose the greatest threat to a child's well-being. Despite advances in our understanding of fetal alcohol spectrum disorders, there is still much to be learned about the ways in which maternal alcohol consumption can alter the developing brain.

Researchers have begun to use a recently developed technology called diffusion tensor imaging (DTI) to probe the integrity of the brain's white matter. DTI enables appreciation of the ways in which nerve bundles are oriented in space, and in some cases may be more sensitive to tissue pathology than traditional neuroimaging. Because white matter contains the nerve fibers best suited to transfer information quickly between brain regions, structurally coherent white matter is important for supporting effective cognition.

In a study published in the March, 2009 issue of *Alcoholism: Clinical and Experimental Research*, Fryer and colleagues observed altered white matter microstructure in individuals with FASDs, even though total brain size was equivalent between alcohol-exposed and comparison participant groups. Decreased white matter integrity was found most prominently in fibers traversing areas of the frontal and occipital lobes of the brain, regions associated with executive and visual aspects of cognition, respectively. There was also evidence of disrupted integrity of the corpus callosum, which supports information transfer between the two hemispheres of the brain. The corpus callosum has previously been shown by a number of studies to be affected by maternal alcohol consumption during pregnancy, including whole-brain DTI studies by Li et. al. and Sowell et. al. The latter study found a relationship between decreased white matter integrity in the corpus callosum and poorer visual-motor skills, in alcohol-exposed children, suggesting that decreases in white matter microstructural coherence have behavioral relevance.

In summary, DTI techniques are providing convergent evidence that developing white matter is vulnerable to the damaging effects of gestational alcohol exposure. Future research will continue to explore how these alcohol-related changes in the brain's white matter correspond to the every day problems faced by people with fetal alcohol spectrum disorders. Ultimately, researchers hope that a better understanding of the brain-behavior relationships that underlie these disorders will lead to improved treatment and outcomes for affected individuals.

Citations:

- Fryer SL, Schweinsburg BC, Bjorkquist OA, Frank LR, Mattson SN, Spadoni AD, Riley EP. Characterization of white matter microstructure in fetal alcohol spectrum disorders. *Alcohol Clin Exp Res*. 2009 Mar; 33(3):514-21
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