

Impact of Breastmilk on Microstructural Brain Development in VLBW Infants



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What is the study about?

Infants born at very low birth weight (VLBW <1500g) experience a high incidence of neurocognitive dysfunction, even in the absence of structural brain injury. Early breast milk feeding has been linked to increased volumetric brain growth and improved cognitive and behavioral outcomes.

Through advanced quantitative MRI (qMRI) techniques such as diffusion tensor imaging (DTI) and volumetric segmentation, we compared the effects of breast milk versus preterm formula on volumetric brain growth and white matter microstructural development in VLBW infants on MRI obtained at term-equivalent age. Using volumetric segmentation, we found no significant difference in global and regional brain volumes between breast milk and formula-fed infants ($p= 0.25-0.89$), but infants receiving breast milk demonstrated significantly greater white matter microstructural organization within regions of the cerebrum and cerebellum (greater FA in the left posterior limb of internal capsule and middle cerebellar peduncle).

What are the benefits of greater white matter microstructural organization?

White matter is composed of neuronal axons that play an important role in communication in the brain. Preterm infants experience a high incidence of white matter injury and impaired cerebral cortical development resulting in later neurodevelopmental impairment. Interventions that improve white matter microstructural organization could help minimize and protect against neurocognitive, behavioral, and motor impairments later in life.

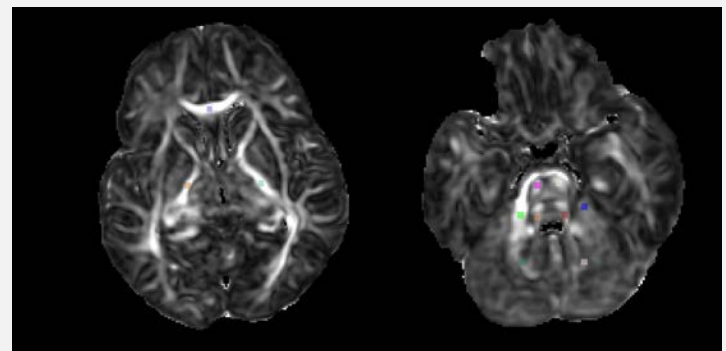
How might breast milk aid white matter development?

The fact that these white matter differences are evident in early-developing regions of the brain and are present by term-equivalent age may suggest a protective effect and important role of early breast milk feeding in helping to establish these neural connections. The etiology of breast milk's neurocognitive benefits are not yet known, but it has been hypothesized that specific components present in breast milk, such as long-chain polyunsaturated fatty acids (LCPUFA, DHA and arachidonic acid), might promote axonal growth and development.

Why is breast milk and nutrition relevant to the work that we do in the Developing Brain Research Program?

Nutrition is relevant to our work because it plays a crucial role in the developing brain. The nutritional research we perform has the potential to help optimize nutritional interventions in the NICU in order to improve preterm brain development.

DTI Images



DTI parametric maps of *A*) genu of corpus callosum and posterior limb of internal capsule and *B*) pons, middle cerebellar peduncle, and superior cerebellar peduncle.



March for Babies Update

Thank you to everyone who participated to show their commitment to helping families and saving babies lives !

Research Presentations

Catherine Limperopoulos. The Society for Research on the Cerebellum and Ataxia (SRCA) International Symposium, May 2017 Winnipeg, Canada

Nickie Andescavage. "Placental textural analysis in the growth restricted fetus using 3D MRI." International Society for Perinatal Diagnosis. July 2017 San Diego, CA

Yao Wu. "Maternal Stress Alters Hippocampal Development in Fetuses with Congenital Heart Disease." International Symposium on the Fetal Brain-August 2017 Washington, DC

Katherine M. Ottolini. "Breastmilk Feeds Improve Brain Microstructural Development in Very Preterm Infants." International Symposium on the Fetal Brain-August 2017 Washington, DC

Nickie Andescavage. "In Vivo Placental Microstructure in the Growth-Restricted Fetus Using Magnetic Resonance Based Shape and Textural Analysis." International Symposium on the Fetal Brain-August 2017 Washington, DC-Abstract

New Team Members



Adrian Paez
R&D Staff Engineer 1



Shahleen Ahmed
Clinical Research Coordinator



Kathleen Van Hoose
Clinical Research Program
Coordinator



Reka "Princi" Kovacs
Clinical Research Coordinator

Featured Press

Featured in the article: "Focusing on the brain's fluid-filled spaces during fetal growth" in CNHS: Innovation District. May 2017.

Featured in the article: "More proof that breastfeeding benefits babies' brains" by Christopher Bergland in Psychology Today. May 8, 2017. brains

Featured press on CNHS website: "Breast milk appears to aid white matter microstructural organization in preemies' developing brains" May 2017 emies/

Congratulations!!

Subechhya Pradhan, PhD for her recent Clinical and Translational Science Institute Research Award that will focus on, "Non-invasive metabolic assessment of the placenta in vivo."

CNHS Bring Your Child to Work Day!



Thank you Hannah and Nathanael for making our day bright!



To our 2017 Summer Interns
Orientation Day : June 12th, 2017

