Omega-3 intake linked to higher cognition in infants, toddlers and young children

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Carol L. Cheatham, PhD, developmental cognitive neuroscientist with the UNC Chapel Hill Nutrition Research Institute (NRI) at the NC Research Campus, has research findings that prove just how critical fatty acids are to the cognitive development and cognitive functioning of infants, toddlers and young children.

A study on the effect of the ratio of omega-6 and omega-3 fatty acids and the cognitive abilities of children seven to nine years of age were recently published in The *American Journal of Clinical Nutrition*.

In the study, dietary data confirmed the ratio of each child's omega-6 to omega-3 intake. After taking a set of neuropsychological tests, Cheatham said, "children who were eating too many omega-6 in comparison to omega-3 had slower speed of processing on working memory and planning problems."

The comparison is important because omega-6, which is found in meats and refined vegetable oil is more abundant in the Western diet. Research has connected the over-consumption of omega-6 fatty acids to chronic inflammation, an underlying factor in heart disease, cancer and other common diseases. Omega-3 fatty acids are linked to the regulation of blood clotting and are considered heart healthy because they lower fats or triglycerides in the blood including the "bad" low-density lipoprotein (LDL) cholesterol. Unfortunately, the typical American diet includes relatively few foods that are rich in omega-3 compared to those high in omega-6.

"Think of omega-6 as fatty acids as French fries and omega-3 as vegetables," Cheatham said. "Intake needs to be in balance because the metabolic pathways share the same enzymes. If the pathways get out of balance because you are eating more omega-6 than omega-3, the enzymes get used up, and you won't be able to make your own DHA (docosahexaenoic acid)because you will be out of the things you need to make it."

Genotype, DHA and Cognition

DHA is an omega-3 fatty acid proven to support brain, heart and eye health in toddlers and infants. It can be made by the human body, but dietary intake of DHA-rich foods like eggs, broccoli, cauliflower, spinach and salmon, tuna, halibut, cod, and other coldwater, fatty fish is recommended to maintain adequate levels. Because DHA is needed for the proper development and functioning of memory and the hippocampus, it is commonly added to baby formulas.

Cheatham found that seven percent of the United States population cannot make sufficient levels of the fatty acid. She wondered what effect this could have on the cognitive development of children. Working with NRI colleague Mihai Niculescu, PhD, Cheatham started investigating a specific single-nucleotide polymorphism (SNP) related to fatty acid metabolism. A SNP is a genetic variation or "misspelling" in a person's genetic code.

Based on this SNP, Cheatham designed an experiment with 16-month-old toddlers feeding them flaxseed oil for four months. The age is significant because toddlers are not on formula at that point. Cheatham theorized that the flaxseed would provide a consistent substrate from which the toddlers could make their own DHA.

Cheatham's findings were surprising. She found that if a mother had a GG genotype, her children had lower declarative memory abilities when the study started. A GG genotype is thought to mean that the mother cannot make DHA because of two recessive alleles at the specific SNP being studied. With regular flaxseed supplementation, these children finished the study with the highest scores on the declarative memory task with which they were assessed.

"There wasn't any difference across the four months in the children's cognition," Cheatham admitted, "unless we divided by not the child's genotype but by their mother's genotype. We are talking about 16- month-old children, and their mother's genotype is still more important to them metabolically than their own."

In another study, she looked at mothers with the GG genotype and the influence of DHA deficits in the placenta and breast milk. Similar to the toddlers, six-month-old babies from GG mothers had lower recognition memory skills at the time of testing.

"If mom is GG, her baby at six months of age could not tell the difference between old and new pictures in an electrophysiology paradigm, which all six month old babies should be able to do," Cheatham said. "These studies really speak to the need to identify the mothers who are GG and make sure they are eating enough fatty fish and eggs."

And Cheatham emphasized, identifying these mothers is as easy as a genetic analysis of their saliva.

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