

## **Choline and Perinatal Nutrition: What HealthCare Providers Need To Know**

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### Choline is an essential nutrient that can be likened to docosahexaenoic acid (DHA)

Similar to DHA, choline can be made in the body but not in amounts that are sufficient to meet human requirements, which are especially high during pregnancy and lactation (1,2). Low choline intakes throughout the perinatal period are of concern because, like DHA, choline is required for proper brain development and function (3). In this regard, choline is used to make several biomolecules with fundamental roles in brain structure, organization and function (4-6). The neurotransmitter, acetylcholine, supports proper functioning of the hippocampus, a region of the brain involved in memory, learning, and attention. The phospholipids, phosphatidylcholine and sphingomyelin, provide the building materials for fetal brain development and ensure efficient transmission of nerve signals throughout the central nervous system. The choline-derived methyl donor, betaine, provides methyl groups that can be attached to regulatory regions within the fetal genome, a process known as epigenetic modification, which in turn can have lasting effects on gene expression within the developing brain and other tissues (7,8).

### Supplementing the maternal diet with additional choline during the perinatal period improves offspring cognitive outcomes and protects against some neural insults

Decades of rodent research have shown that supplementing the maternal diet with additional choline throughout the perinatal period improves cognitive functioning in the adult offspring (9,10) and protects the brain from the neuropathological changes associated with Alzheimer's disease, fetal alcohol syndrome, and inherited conditions such as Down syndrome (5,6). Emerging data from human studies report that a higher prenatal choline intake improves processing speed among infants (11), and associates with better visual memory among seven year old children (12). In addition, choline supplementation given across gestation, and then postnatally to the infant, improves cerebral inhibition, an indicator of attention, at 5-weeks of age (13), and yields fewer attentional and social withdrawal problems at 40-weeks of age (14).

### Higher intakes of choline during pregnancy may afford additional health benefits for both mother and child

In addition to improving offspring cognition, a higher maternal choline intake during pregnancy is associated with a lower risk of having a baby with a neural tube defect (15) as well as reduced placental production of an anti-angiogenic factor linked to preeclampsia (i.e., sFLT1) (16). Consumption of additional choline during pregnancy has also been shown to attenuate stress reactivity in the newborn via epigenetic modifications of genes within the placenta that influence cortisol production by the fetus (8). Finally, a higher choline intake may increase DHA supply to the developing fetus in early pregnancy by enhancing hepatic export of DHA into the maternal circulation (5,17).

Most pregnant and lactating women are not consuming recommended intakes of choline, and would likely benefit from increasing dietary and/or supplemental choline intake

The Institute of Medicine (now National Academy of Medicine) established dietary recommendations for choline in the form of adequate intake (AI) levels (18). The AI for women of reproductive age is 425 mg choline/d with upward adjustments to 450 mg choline/d for pregnant women, and 550 mg choline/d for lactating women (secondary to the high choline content of breastmilk) (1, 18). Of note, usual choline intakes among pregnant women are estimated to be 320 mg/d, and less than 10% of pregnant women meet target intake levels (19). Choline intake can be enhanced during the perinatal period by increasing consumption of choline-rich foods such as egg yolks, beef, chicken and fish (1). For women who are unable to achieve intake targets through diet alone, supplemental choline should be considered. The American Medical Association in 2017 announced it will support actions to boost choline amounts in prenatal vitamins (20), while the importance of choline as a “brain-building” nutrient was highlighted by the American Academy of Pediatrics in 2018 (3).

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