

Choline & Fetal Development

Choline: The “New” Essential Nutrient

Discovered in 1862 by Andreas Strecker, choline remained unrecognized as an essential nutrient until 1998, when Dietary Reference Intakes (DRIs) were finally established by the Food and Nutrition Board of the Institute of Medicine. Choline is the key metabolic precursor of two key physiological compounds—phosphatidylcholine and acetylcholine. This fascinating nutrient plays diverse supporting roles in human physiology—it strengthens cell membranes as a key structural component of phosphatidylcholine, plays an integral role in keeping homocysteine levels in check, is vital to the synthesis of the neurotransmitter, acetylcholine, insulates nerve fibers as a component of sphingomyelin, and aids in memory development and cognition.

Adequate maternal choline stores are vital to a healthy pregnancy. Because there is a high rate of choline transfer from mother to fetus^{1,2,3}, pregnancy places high demands on maternal choline stores⁴; and because human milk is rich in choline, the need for these reserves does not diminish after birth; rather, it increases to meet the demands of a rapidly growing and developing infant^{5,6}. Adequate maternal choline intake is critical not only for proper fetal brain development⁷, but also for maintaining normal maternal homocysteine levels. Elevated maternal homocysteine has been associated with an increased incidence of birth defects⁸.

Although choline is produced endogenously, it is thought that the output from de novo synthesis is not adequate to keep up with human needs over the life cycle. It is found primarily in the form of phosphatidylcholine (lecithin) in foods such as beef liver, egg yolk, soybeans, beef, milk, and peanuts; however, free choline is also found in beef liver, oatmeal, soybeans, iceberg lettuce, and cauliflower, among other food sources⁹. Scientists are just beginning to appreciate choline’s vital roles in cardiovascular health, memory function, and perhaps most importantly, fetal brain development.

Prevention of Neural Tube Defects

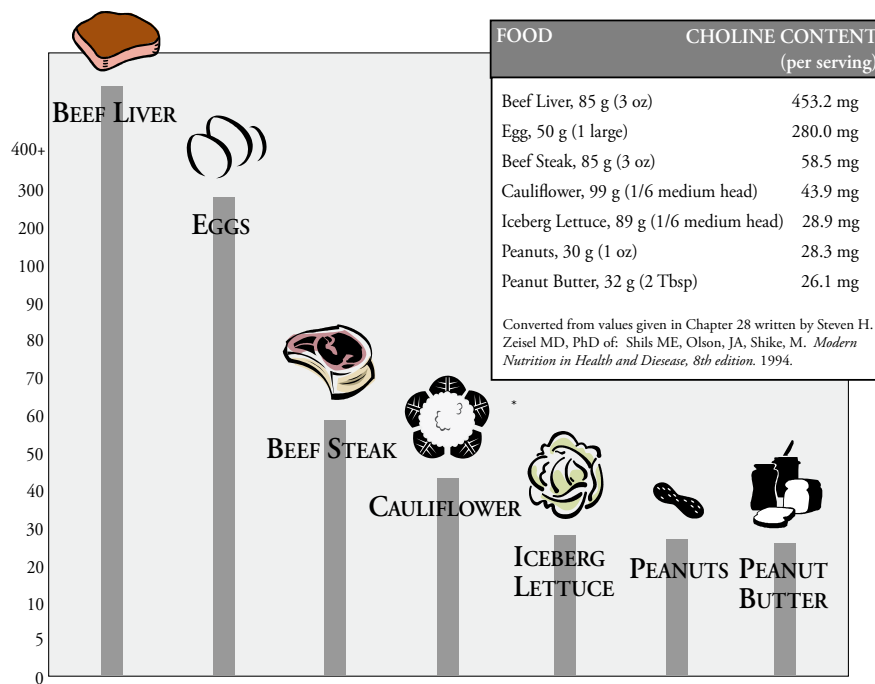
Like folate, choline has been shown to decrease the incidence of neural tube defects. Animal studies indicate that choline is vital for proper neural tube closure^{10,11} and human studies support this finding. One study showed that the risk of having a baby with a neural tube defect was four times greater for women in the lowest quartile of choline intake compared to those in the highest¹².

One reason for this finding may be that choline functions as a methyl donor in the synthesis of methionine from homocysteine. It is thought that choline’s role as a methyl donor is especially important when folate intake is low. In fact, it has been shown that methionine and folic acid together might prevent neural tube defects such as spina bifida and exencephaly by supporting methyl group metabolism or by keeping homocysteine levels in check¹¹.

Life Stage	Adequate Intake (mg/day)
Infants	
0-6 months	125
7-12 months	150
Children	
1-3 years	200
4-8 years	250
Males	
9-13 years	375
>13 years	550
Females	
9-13 years	375
14-18 years	400
>19 years	425
Pregnant	450
Lactating	550

Cognitive Development

Animal research shows that differences in choline intake during critical periods of development influence the electrophysiology of specific regions of the brain—and that these changes last well into adulthood. Maternal choline supplementation in rodents during late pregnancy (when the hippocampus is developing) lead to positive changes in brain function and memory, which persisted throughout life. These findings underscore the importance of adequate choline intake during pregnancy for optimal brain and memory development¹³⁻¹⁴.



In 2001, the Food and Drug Administration (FDA) allowed a nutrient content claim on labels of foods that meet the following criteria to be termed "good" or "excellent" sources of choline:

Excellent
source of choline

Must contain at least 110 mg of choline per serving,
(20% of the Daily Value for choline based on 550 mg reference)

Good
source of choline

Must contain at least 55 mg of choline per serving,
(10% of the Daily Value for choline based on 550 mg reference)

Citations...

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