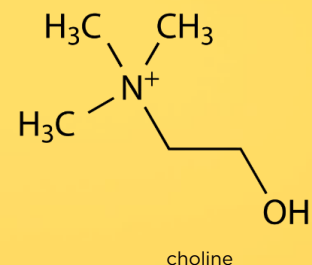




Choline

A Vitamin-Like Essential Nutrient



What is Choline?

While choline is not strictly defined as a vitamin, it is an essential nutrient that our bodies can synthesize in only very small amounts. Therefore, choline must be consumed in the diet to maintain health, yet 92% of US adults under-consume this essential nutrient¹. National survey data reveals U.S. adults are not meeting dietary intake recommendations for choline. For younger adults aged 19-50 y, the usual daily intake of choline from food for females was 271 mg and 405 mg for males (Adequate Intake for choline is 425 mg/day for females and 550 mg/day for males over 19 years old).

For older adults aged 51+ y, the usual intake of choline was 276 mg for females and 395 mg for males. Adding supplements did not fill the dietary gaps.² Most of the body's choline is found in fat molecules called phospholipids, the most common of which is called phosphatidylcholine.³ Choline and its metabolites (phosphatidylcholine, acetylcholine, betaine, and sphingomyelin to name a few) are responsible for a number of biological functions, described below.

What are the Roles of Choline in the Body?

Structural component of all cell membranes

Choline is needed to synthesize phospholipids, such as phosphatidylcholine and sphingomyelin, that are essential structural components of all cell membranes (the barrier that separates the contents of a cell from its outside environment and controls what moves in and out of the cell). Phosphatidylcholine accounts for about 95% of choline in tissues.⁴ Sphingomyelin is found in cell membranes and in the fatty sheath that protects myelinated nerve fibers. Phosphatidylcholine and sphingomyelin are precursors for cell-signaling molecules, allowing communication between individual cells.

Supports healthy brain and nervous system function

Choline is needed for nerve impulse transmission by helping to transport signals across the brain and nervous system. Choline is a precursor for acetylcholine, an important neurotransmitter involved in memory, mood, muscle control, and many other functions.⁵

Essential for fat and cholesterol transport in the body

Dietary fat is transported to the liver by chylomicrons (triglyceride-rich lipoproteins that deliver dietary triglycerides from the GI tract to the tissues immediately after a meal). In the liver, fat and cholesterol are compiled into very-low-density lipoproteins (VLDL) for transport in the bloodstream to other tissues. Phosphatidylcholine is needed for VLDL assembly and secretion from the liver. Without adequate phosphatidylcholine, fat and cholesterol may accumulate in the liver.⁶

Why is Choline Important in Pregnancy and Breastfeeding?

During pregnancy, choline is necessary for placental and fetal brain development (including several aspects of cognitive function like learning, memory, and attention) and to support fetal organ growth. The choline metabolite betaine is a methyl group donor needed for DNA methylation reactions that occurs during fetal development - essential for gene expression, cell differentiation and the formation of organs.⁷ In pregnancy, a mother transfers large amounts of choline across the placenta to the fetus, and similarly during breastfeeding via breast milk, placing an increased demand on maternal stores during pregnancy and lactation.⁸

Recent research indicates that children born to women who supplemented with choline in the third trimester of pregnancy (380 mg/day dietary choline + 550 mg/day supplement) showed improvements in information processing speed as early as 4-13 months of age.⁹ A follow-up study of those same children at age 7 reported a higher level of accuracy in sustained attention tasks, suggesting that choline supplementation during pregnancy improves children's sustained attention and cognitive function.¹⁰

Nationally representative survey data indicates that pregnant women are consuming only 277 mg choline a day and most American women of child-bearing age are not meeting recommended needs (96% of women ages 15-30 years and 94% of women ages 31-50 years are not consuming enough choline through their diet).¹¹⁻¹² The latest Dietary Guidelines for Americans notes the importance of choline during pregnancy and lactation for proper brain and spinal cord development, and that most women do not meet recommended intakes of this important nutrient.¹³

How Much Choline Do I Need?

Choline is present in foods mostly of animal origin such as meat, poultry, fish, dairy and eggs, as well as some plant sources like wheat germ, broccoli, and Brussels sprouts. The Adequate Intakes for choline set by the Food and Nutrition Board for children and adults are shown in the table.¹⁹ Vegans and strict vegetarians who do not consume dairy or eggs may be at risk for not meeting the recommendations above and should consider taking a supplement.

AGE	MALE	FEMALE	PREGNANCY	LACTATION
0-6 months	125 mg/d	125 mg/d		
7-12 months	150 mg/d	150 mg/d		
1-3 years	200 mg/d	200 mg/d		
4-8 years	250 mg/d	250 mg/d		
9-13 years	375 mg/d	375 mg/d		
14-18 years	550 mg/d	400 mg/d	450 mg	550 mg
19+ years	550 mg/d	425 mg/d	450 mg	550 mg

Does Choline Help Support Focus and Attention?

In the brain, acetylcholine plays an important role in motor control, attention, and focus. Brain and nerve cells need choline to support cognitive health at any age and sufficient intake of choline throughout the lifespan is essential for learning, memory, and attention. Choline supplementation has been shown to significantly increase choline-containing compounds in the brain.¹⁴ Studies have shown a link between cognitive performance in adults with higher choline intakes and plasma concentrations. Observational studies suggest that higher intakes of choline are associated with higher cognitive function and improved memory in both males and females.¹⁵⁻¹⁷ In one double-blind, placebo-controlled study, college-age students who supplemented with 800 mg choline demonstrated higher levels of focus and attention on visuomotor “click and aim” performance tasks on a computer that required the coordination of eye and hand movements.¹⁸ These results denote the importance of choline in the brain to support focused attention on tasks that require coordinated visual and motor skills.

Should I Add a Choline Supplement to My Daily Routine?

It's important for patients to communicate with their healthcare professionals about any changes to their daily regimen including dietary supplements. Work together to understand personal nutrition needs as well as current dietary patterns to identify nutrient gaps. For those who are still unable to meet their nutrient needs from diet alone, it's important to discuss the need to fill any potential nutrient gaps with dietary supplements, as a safe and effective way to ensure adequate intake of all essential nutrients.

About Nature Made

Over the last 50 years, Nature Made has been a trusted leader in the wellness industry. They have helped pioneer quality standards for vitamin, mineral and herbal supplements, and remain dedicated to formulating products backed by science. Committed to Good Manufacturing Practices (GMPs), Nature Made's quality extends to every aspect of our production, from purchasing high-quality raw materials to routine testing for purity and potency. In fact, they were the first national supplement brand to have a product verified by United States Pharmacopeia (USP), and it is the national supplement brand with the most products carrying the USP Verified Mark, verification that products meet stringent quality criteria for purity and potency. Nature Made is also the #1 Pharmacist Recommended Supplement Brand in 9 Categories*

These materials are intended for educational purposes only.

*Based on U.S. News & World Report - Pharmacy Times Survey, 2021.

†These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure or prevent any disease

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