

CHOLINE

The "New Folic Acid"

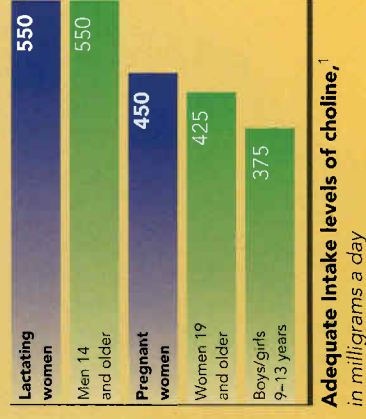
Although discovered in 1862, choline wasn't recognized as a nutrient essential for human health until 1998 when the Food and Nutrition Board of the Institute of Medicine established a Dietary Reference Intake level for choline.¹

What does choline do?

Choline strengthens cell membranes all over the body and is a vital chemical component of the nerve messaging system. We are still learning more about choline's role in normal fetal brain development where it appears to be especially important during developmental stages that involve acquiring knowledge and sustained memory function.²

Does the need for choline increase during pregnancy and lactation? Yes.

There is a high rate of choline transfer from mother to fetus in which the growing fetal demand for choline may deplete maternal choline stores if dietary intake has been inadequate. Human milk is especially rich in choline, placing increased demand on the maternal supply of choline to nourish the growing infant.³

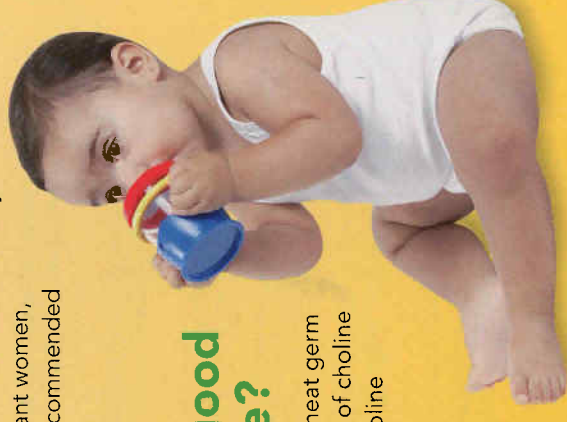


What happens if there's not enough choline for the developing fetus?

Maternal diets that are deficient in choline have been associated with increased risk for neural tube defects even when other nutrients such as folic acid and other B vitamins were in adequate supply. Folic acid and choline work together in many of the biochemical reactions that involve proper fetal nervous system development.⁴

Is there a reason to be concerned about choline intake in the US? Yes.

Recent research has shown that there is a gap between adequate intake and the average intake of choline in the US. A dietary assessment of choline intake conducted by Iowa State University showed that adults, including pregnant women, consume far less than the amount recommended as an adequate intake for choline.⁵



What foods are good sources of choline?

Beef liver, chicken liver, eggs and wheat germ are all considered excellent sources of choline (must contain at least 110 mg of choline per serving to be considered an excellent source).²

How much choline is needed during pregnancy and lactation?

An Adequate Intake (AI) of choline is:¹

- 425mg/day for an adult non-pregnant woman
- 450mg/day during pregnancy
- 550mg/day for breastfeeding women

Many prenatal vitamins do not currently contain choline, so the best source of choline remains from food.

Choline content per serving size, in milligrams a day

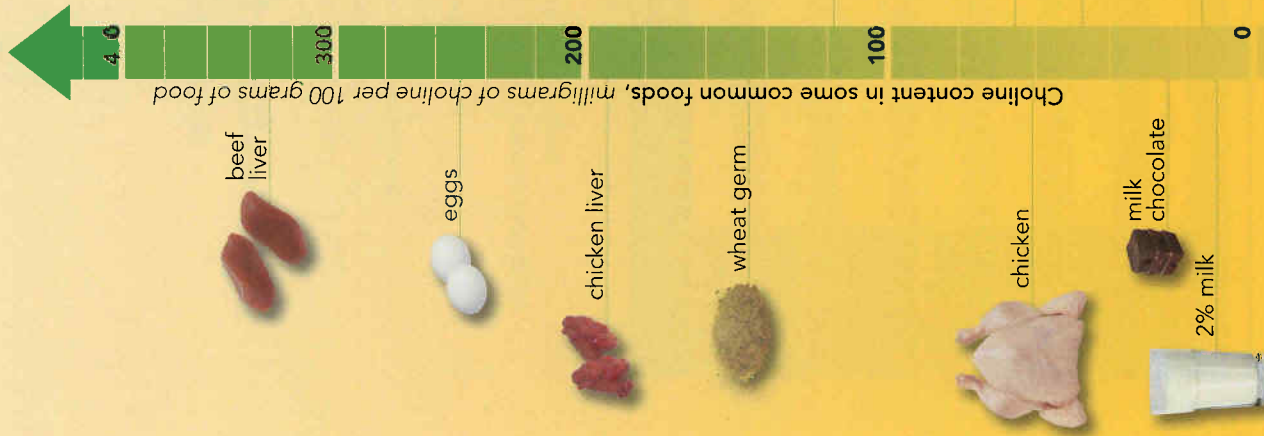
Food source	mg Choline/100g	single serving size	mg Choline/serving
Beef liver	333.2	3 oz	284.7
Egg	251.0	2	251.0
Chicken liver	194.5	3 oz	166.7
Cheeseburger	29.0	1 sandwich	72.5
Salmon	65.4	3 oz	56.6
Chicken	59.7	3 oz	51.2
Nonfat, fruit yogurt	16.4	1 cup	41.0
Pepperoni Pizza	26.4	1 slice	39.6
Wheat germ	152.1	¼ cup	38.0
2% milk	16.4	1 cup	32.8
Tofu	27.3	½ cup	30.0
Bacon	46.7	2 slices (2 oz.)	26.6
Bean & Cheese Burrito	27.6	1 piece	25
Broccoli	18.7	½ cup	6.2

Based on U.S. Department of Agriculture Database for the Choline Content of Common Foods, 2004.

Baby Builder

Everyone needs to get enough choline in their diets to stay healthy.

Choline intake is especially critical during pregnancy and lactation, two eggs supply more than half a pregnant woman's adequate intake (AI) for choline.



Based on U.S. Department of Agriculture Database for the Choline Content of Common Foods, 2004



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Could this baby
be **MISSING**
something?

¹ Dietary Reference Intakes, Institute of Medicine of the National Academies, National Academies Press, Washington DC, 2006.

² Zeisel SH. Choline: Critical Role During Fetal Development and Dietary Requirements in Adults, *Annu Rev Nutr*, 2006, 26, 229-50.

³ Zeisel SH. Nutritional importance of choline for brain development, *J Am Col Nutr* 2004, 23, 621S-626S.

⁴ Molloy AM et al Choline and homocysteine interrelations in umbilical cord and maternal plasma delivery, *Am J Clin Nutr*, 2005, 82, 836-42.

⁵ Shaw GM, et al Periconceptional Dietary Intake of Choline and Betaine and Neural Tube Defects in Offspring, *Am J Epidemiol* 2004, 160, 102-109.

⁶ Barres-Marquez SP, et al Choline in the diets of the US population: NHANES, 2003-2004, Iowa State University (accepted for presentation- *Experimental Biology* 2007, Washington DC)