

## Choline: A Nutrient to Remember

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In 2001, choline was the first nutrient to be approved for food-labeling claims under the FDA Modernization Act of 1997.<sup>1</sup> Indeed, choline deficiency in the American diet might become a public health issue. Once considered rare, it may be that our avoidance of choline-rich high-fat and high-cholesterol foods, such as nuts, egg yolks and beef liver, and our ever-worsening Standard American Diet (SAD) eating habits are the culprits.<sup>2</sup>

Because the body can make choline, scientists for years debated whether people needed to supplement their diet with this nutrient. In 1998, however, an expert panel convened by the Institute of Medicine (IOM) in Washington, D.C., concluded that diets low in choline might lead to serious health problems. The IOM recommends 550 mg/day for men and 425 mg/day for women to ensure adequate daily intake.<sup>3</sup> However, a study published in April 2005 in the *American Journal of Clinical Nutrition* concluded that average consumption in the U.S. is just 314 mg per day.<sup>4</sup> To compound this finding, according to the Opinion Research Corporation, awareness of choline, its sources and its benefits is extremely low among American adults.<sup>5</sup> Since awareness is presently so low, the appearance of choline content on labels may not be enough to promote choline awareness and consumption - unless it's combined with other efforts to raise awareness. Therefore, I have presented this article to my fellow chiropractors.

### The Yolk's on Us

Choline is a natural amine, C5-H15-NO2. From 1844 to 1846, Gobley isolated a substance from egg yolk which he called "lecithin," from the Greek word *lekithos*, meaning egg yolk. By 1940, researchers confirmed what they considered its vitamin nature. However, it turns out that technically, choline has no known co-enzyme function, but it is still recognized as being closely associated with the vitamin B family.

Choline is found either as free choline or esterified in the "head" group of the bipolar phospholipids (phosphatidylcholine, glycerol-phosphocholine and sphingomyelin) and in the neurotransmitter acetylcholine. Methionine and folic acid are also essential for the synthesis of these phospholipids, as vitamin B<sub>5</sub> is for the neurotransmitter. Choline is understood to play an important role in fetal CNS development, nervous system and cognitive function, cellular membrane structure and lipid metabolism. As pertains to liver function, choline acts as an important betaine methyl donor and lipotropic, helping export fat from the liver.

Natural dietary sources include eggs, beef liver, soy lecithin, nuts and marine fish, usually as phosphatidyl choline (PC). Free choline is found in vegetables such as cauliflower and green leafy vegetables. Small amounts are used in processed foods, usually as lecithin and as an emulsifier.

Since 2001, the FDA has permitted food products to advertise choline content on their labels, depending on whether they meet criteria to be classed as a "good" or an "excellent" source. Fifty-five milligrams of choline constitutes a "good source," whereas 110 milligrams of choline is an

"excellent" source.<sup>6</sup> The critical, adverse effect from too much choline is hypotension, usually with other "cholinergic" side effects, including sweating, diarrhea and a fishy body odor. The Tolerable Upper Intake Level (UL) for adults is 3.5g/day. Deficiency signs are rare and include muscle weakness, tingling in the fingers and toes, weight loss or fatigue.<sup>7</sup>

#### Lecithin for Better Memory and Cognition, Clearer Arteries, and Liver Fat Mobilization and Detoxication

Given the 2001 FDA approval, expect savvy processed food manufacturers and functional food providers to begin promoting the choline content in their products more and more. Most often, they will do this by adding lecithin, a major choline-containing ingredient in soy.

Lecithin is a phospholipid that is part of all cell membranes. It consists of phosphorus, choline, inositol and linoleic acid. Although a lipid, lecithin is partially water-soluble and therefore acts as an emulsifying agent that helps disperse fats, protecting vital organs and arteries from fatty buildup. Although lecithin is found in almost every tissue of the human body, it is present in greater concentrations in the nervous system as a component of the myelin sheets that cover nerve cell membranes. More research is needed to determine whether choline intake is useful in the prevention of memory loss or dementia in humans. It has not been found, however, to be a useful treatment for dementia.

Lecithin has been shown to mildly decrease total cholesterol while raising HDL, the "good" cholesterol, and lowering homocysteine, thus perhaps reducing the risk for heart attack, stroke, and hardening of the arteries. Furthermore, lecithin promotes healthy liver function, including bile flow and fat breakdown, thereby supporting energy production through fat burning. Lecithin aids drug and alcohol detoxification. It may help prevent gallstones. Finally, lecithin helps repair the lipid cell membrane, and aids in absorption of thiamin by the liver and vitamin A by the intestine.<sup>7</sup>

For makers of functional food drinks and drink powders, such as whey, meal replacements, and greens drinks, lecithin is more than just a nutritious ingredient. Being a natural emulsifier, lecithin helps to "instantize" the product, so it mixes easily without clumping. Lecithin can be taken as a supplement in capsules or sprinkled on foods as a powder. Organic soy lecithin powder is not yet available. However, non-genetically-modified soy (non-GMO) is more expensive. The percentage of phosphatidyl choline in functional foods varies from around 10 percent to 23 percent.<sup>7</sup> The higher PC content also is more expensive, but richer in choline content. A product using a lecithin that is 20 percent PC would be supplying about 3 mg per 100 mg of lecithin. Therefore, a 2,000-mg dose would supply 60 mg of choline. Such a product would be considered a "good source" of choline.

It should be noted that soy lecithin does not contain significant soy protein or protein isolates; therefore, it does not commonly trigger soy-related allergic reactions.

#### Liposomes: The Tiniest Fat Bodies

Liposomes, literally "fat bodies," are colloidal nanoparticles with membranes usually composed of a phosphatidyl choline (PC) double membrane or "bi-layer." They can encapsulate a significant percentage of the solvent in which they are suspended. As nanosized liposomes are readily absorbed, they can enhance the bioavailability of otherwise poorly bioavailable nutrients. Of interest, if one ingests PC in a food like lecithin, it is broken down into free choline before digestion. Once in the bloodstream, the body re-creates PC. However, when one ingests PC as part of a liposome, PC is absorbed as such, for when the liposome is digested by enzymes in the blood, the nutrient is released and the intact, whole PC is set free.

## Choline Conclusion

Foods and supplements may now be labeled as 'good' or 'excellent' sources of choline. Some people may do well to review and optimize their choline intake, especially expectant mothers and populations at risk for CVD, cirrhosis and perhaps dementia. Nuts, eggs and soy are "excellent" natural choline dietary sources that can be included in most balanced diets. Lecithin from soy can be supplemented in pills or powder. On the functional-food side, greens products providing about 2 gm of lecithin per serving, containing 20 percent phosphatidyl choline, are likely "good" sources as well. If natural submicron and nanosized PC liposomes are included to enhance bioavailability, even more choline will be provided. To learn more, [click here](#).

## References

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